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CHINESE FRONTIERS OF INDIA.*

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The North-East Frontier.

In the course of the twenty-two centuries which have elapsed since the descent of Alexander the Great and his Macedonian levies to the Jehlum valley and the plains of the Punjab, the constant passing of armies, and the ceaseless advances of conquering man have made a moving place in history for the mountains and the passes of India's north-west borderland.

Of the North-East Frontier little has been written, and for many years this boundary has remained hazy in its geographical limits, peaceful in its policies, and happy in the dulness of its annals. The events of the past few years, however, have forced this section of the frontier into a new prominence. With the flight of the Dalai Lama from Lhasa in February, 1910, we were brought to a sudden realization of the fact that China desired to inaugurate a forward policy in Tibet, and that India had acquired a Chinese neighbour along the whole stretch of that 3000 miles of frontier from Kashmir, past Nepal, Sikkim, Bhutan, Assam, and Upper Burma, till we reach the Mekong and Tongking. Not that China is playing a new part in asserting her power in Central Asia or that Chinese ambitions and Chinese policies are an unknown factor on the Indian borderland. We see, however, these ambitions and policies recalled to life after a long sleep, and carried through with a new vitality. The Chinese colossus has moved in its extremities, its farthermost limbs, when the heart seemed to be failing and the centre of all its activities in Peking was over-burdened with troubles from within and from without, and seemed for the moment numbed and almost broken.

* Royal Geographical Society, January 15, 1912. Map, p. 312.

Since the conquest of Kashgaria by the Emperor Chienlung in 1759, the sway of China has been recognized as far as the Kashmir border with but a little break in the days of Yakub Beg and his Mohammedan rebellion. She has bounded our Indian Empire, too, along the whole of the Burma frontier for several centuries, though it is but in the last few years that she has attempted to carry her administrative frontier up to her political border line. She has exercised a shadowy and intangible suzerainty in Tibet since the eighteenth century, and now she has at last asserted claims which are more than those of a suzerain in that mysterious and distant dependency. She has carried her arms to the sacred city of Lhasa, has driven the Buddha incarnate with but little ceremony from his spiritual throne, and has even asserted claims over Nepal, Bhutan and Sikkim which have attracted the attention of the world.

China has excited but little general interest in western Europe until recent years. We have known of those industrious millions leading laborious lives in their ricefields, packing their tea and their bales of silk in the great yellow plains of the Pacific coast, or importing the cottons of Manchester and sending them in heavy-sailed junks far into the Chinese hinterland from which the Yangtse flows. China, however, has been little more than a name, a market, an unaggressive people slowly rising from the apathy of centuries of sleep. It is impossible to live amongst these industrious law-abiding people without learning for them a liking and respect, as one watches their humorous acceptance of the endless round of monotonous days, days of little sorrow and little joy, a dull and uneventful sojourn to the inevitable end. We have had to fight in China in the past for fair trade and for such relations as may exist with dignity between the nations of the earth, but we have been little worried by Chinese beliefs in their world-wide Empire or in the claim that there can be but one "Son of Heaven" on an earthly throne. We are told that China is the Middle Kingdom, a happy isle rising above the floods of circumambient barbarism; and we are not particularly agitated when reading that, so late as 1793, the Ambassador of His Majesty King George III. was conveyed to Peking in a barge, which bore aloft the legend that His Excellency came bearing tribute from the English King. Such incidents have been accepted as quaint but immaterial side-lights on a country whose soldiers wore targets embroidered on their breasts, but whose merchants were honest purveyors of good teas and regular purchasers of unlimited cotton goods from Manchester. We will trust that they may long remain so, and that the commercial genius of Great Britain and China may serve to link the two nations with a tie that shall be strong enough to withstand the frictions of political controversy, of impulsive boycotts and international strife.

It is inevitable, however, that we should feel for China a new and stronger interest since she has forced upon us the recognition of her neighbourly claims. There are few countries which should prove so satisfactory in this relationship as China, with her peace-loving, slow-moving people,

and her administrative genius. India will be happy indeed on her north-east frontier if China proves true to her tradition, and if she will consent to learn and to fulfil the duties which civilization demands from the nations whose borders march with those of sister powers. Signs are not wanting that this will be a hard lesson for her to learn; she has grown so accustomed to a tribal fringe, to the barbarian hordes to the north and south and west of her broad domains, that she is slow to realize the rapidity with which her modern advance is bringing her to new and undreamed of frontier conditions. Opposite Kashgaria and Chinese Turkestan lies India; administrative advances in Yun-nan bring her to the Indian line in Burma too; her military activity in Tibet brings her again to Assam and to India, and lastly we cannot but regard with interest the political significance of the move, which has installed her as a military power behind the mountains of Bhutan, Sikkim, and Nepal.

I have been asked whether the past few years have shown signs of any real change in Chinese affairs. My own experience prompts me to answer, yes; the changes are very apparent, but their actual value cannot yet be safely gauged. There was a very general and very obvious stir throughout the country after the occupation of Peking by the allied forces, at the time of the Boxer troubles. That, I think, was the first real stimulant to the awakening of China, the first realization of her needs and her possibilities. Before that crisis there was much talk of the break-up of China, but China would not easily break up now; even in the midst of the present eruption we cannot but recognize that her position has been consolidated in some intangible way, and that the eighteen provinces have been brought to some realization of their common interest. The next decisive influence was the outcome of the Russo-Japanese war, which awoke a new ambition throughout the East, whilst losses of Chinese territory have brought to a head the lack of confidence which had gradually been gathering among the people for the past three years.

Whatever may be the visible outcome of the present revolution there is little doubt that the will of the people will triumph, and that China will embark on a new career of progress and national unity, which should be as welcome to the civilized world as to the most enthusiastic members of an awakened China. In dealing with the frontier question we cannot but consider this new factor on our borders. Both geographically and politically China comes closer as a neighbour, and awakes an ever-increasing interest in her weakness or her strength. She has the nucleus of a fine army, and she has an abundance of good fighting material in her sturdy millions, if we may judge from those few occasions when Chinese troops have been led by British officers. If the Government is able to keep the new troops free from the peculation which has sapped the energy and effectiveness of the old military system, they may one day be capable of great things. They have the tradition of that Chinese army which, little more than a century ago, performed the military feat of

overrunning Tibet, and trying conclusions with no less redoubtable a foe than the Gurkhas of Nepal.

It is impossible to see far ahead or to weigh with accuracy the outcome of the next few years. China is now passing through her most difficult and most critical phase. She will probably be too much absorbed in her internal affairs, too much concerned with her social and political reformation, to venture into any external complications. At the same time she will find herself in the difficult position of a country which, although potentially rich, is actually poor; which is hampered by long-recognized corruption among the official classes; and which is nevertheless obliged to support a growing army, and all the expense and strain of reshaping her political and economic machinery.

And so the new progress of China cannot fail to interest, and interest deeply, those countries which are her closest neighbours. During the next few years we shall watch the spread of a national spirit, springing to life with the extension of railways, posts, and general communications. We shall see, too, the far-reaching effects of this new-born experiment in constitutional Government, which should break down provincial prejudices and weld the scattered dominions of the Middle Kingdom into a homogeneous whole. China is so vast, so strong in her own individuality, yet so inscrutable to the western mind, that one hesitates to indulge in generalities as to her present or her future. The more that I see of China, however, especially from the provinces of the interior, the stronger grows the conviction that her greatest strength lies in the intense vitality of her people. Old as they are in history, their spirit is still young and virile. Corrupt as is their official life, they are yet the most honest of peoples. Loving their homes and their families with a love that amounts to a religion, they have yet this genius of spreading across the world, founding prosperous and respected colonies wherever they go, and giving proof of a sterling worth and a persistency of purpose that is worthy of the youngest of nations.

Our oldest frontier relations with the Chinese lie along the Burma-Yun-nan border, and it may help to the realization of our Chinese neighbours, of their border country and their new interest to our Indian Empire, if we consider for a little that wild borderland which marches with Burma for 800 miles, where Yun-nan forms the western boundary of China from the Mekong northwards to Tibet. It is difficult to imagine a country which is still within the boundaries of the Middle Kingdom, yet bearing less resemblance to the long yellow plains of the loess-covered northern provinces, or the densely populated rice-lands of the Pacific coast, than this wild mountain tract among the Central Asian plateaux.

Starting our journey by way of Rangoon and Bhamo, it is but a three days' march to the frontier, and five more on to Têng-yüeh, the first of the Chinese cities. The road is passable only for pack-animals, and one settles down to long daily stages at the head of a caravan of mules, swinging

steadily along over the mountain roads to the rhythm of a pair of sweet-toned gongs, which ding-dong through the silence of the forest. They are pleasant marches, those first few stages through the dense green jungle, the road now overshadowed by great trees, now sweeping up to reveal broad prospects of mountain peaks that fade into the distant haze, now winding along the banks of rocky, orchid-bordered torrents.

Hidden in the mountains on both sides of the frontier-road, are villages of Kachins, a wild and warlike race which causes much anxiety to the Chinese and to the peaceful Shans inhabiting the neighbouring valleys. The men are keen-looking fellows, who spend their days in sharpening their *dhas*, or long two-handed swords, their nights in drinking and in harrying the marches. The burdens of life are literally borne by their women folk, long trains of whom are met along the roads, carrying on their backs great baskets of grain depending from a strap across their foreheads, whilst their hands are busy spinning strands of cotton yarn, or weaving a straw bracelet for their sweethearts, as they toil up the mountain slopes. They wear a short kilt, supported by numbers of loose rattan girdles, the lobes of their ears are pierced and distended to carry long tubes of silver or rolls of red cloth, and their faces are coarsened by hard times. They are hospitable people, these Kachins, offering a welcome to any passing traveller without question or hope of reward. This spirit of hospitality, indeed, is carried to a point which might almost be considered extravagant. I remember a case at a recent frontier meeting in which a trans-frontier Kachin appeared as the complainant. He had accepted an invitation to dinner, dined not wisely, but too well, and fallen down a precipice on his way home. The result was a broken leg, and, in consequence, he now appeared in Court to sue his host for damages. The erring host paid up quite cheerfully, and the international incident was thus amicably settled over the body of a sacrificial pig. These Kachins showed a fierce resistance to the first British columns which entered the country, but they have not been slow to learn the pride of race, and the clean and prosperous administration, which follows British rule. The work of the handful of officers who have been entrusted with the pacification of these hill tracts for the past fifteen or sixteen years, has indeed borne abundant fruit, for the Kachin is a very human fellow, a lazy, superstitious, brave and devoted highlander, and he has been well won.

There is a physical reality about the frontier, which impresses one very clearly as the caravan emerges from the last shady miles of the Burma road and looks down from a commanding peak over the two great Empires, stretching far away to the East and the West. On the one side lies Burma, green and forest-clad as far as the eye can reach, the hills raising their wooded summits from a sea of white and billowing mists, whilst on the other side China stretches away to the sunrise, with hills that are bare of trees, rugged and weather-worn, with every crevice standing clear in the still sparkling air of the winter morning.

And then, as the day advances, we wander down into the northernmost of the Shan States that form the western boundary of China along much of this frontier line, and take our course by the waters of the Taping, that "River of Peace" which is so well named in its quiet sojourn through the country of the Shans.

The Chinese Shan States run in a series of well-watered valleys between the frontier and the great Yunnanese plateau, with roads winding along broad, grassy stretches, above which magnificent banyan trees spread their giant arms and their deep shade. In an avenue of these trees at the little village of Manwyne, Augustus Raymond Margary, the first Consul to visit Têng-yüeh, was murdered thirty-five years ago, winning by his brave march and his fearless death a freedom for all time to foreign travel and foreign commerce in the distant regions of western China. But a few miles farther on, and under just such another clump of trees, George Litton, a noble successor to Margary, was found dead in his sedan chair in 1906. He had spent six years as our Consul in Yun-nan, and all his British enthusiasm and his keen, scholarly mind, had been devoted to the lifting of the veil which then covered so much of far western China. His journeys into Yunnanese Tibet and into the unknown valley of the Upper Salween, added a rich store to our geographical knowledge of the border provinces, and the name of Litton is immortalized among the tribesmen and the Chinese merchants of Yun-nan, who found in this British Consul an unexpected tower of strength in the good cause of fair trade and political freedom.

From the semi-tropical Shan valleys it is but a day's journey to an entirely new world, a long, steep climb through beds of lava and volcanic peaks to the great Yun-nan plateau, at the edge of which, at an altitude of 5400 feet, stand the battlements and towers of Têng-yüeh, the western outpost of Chinese administration. Here there is a Commissioner of the Imperial Chinese Customs Service; for Têng-yüeh—in spite of the fact that it is a journey of eight days from the nearest navigable water—is an "Open Port" under Treaty, and all merchandise on the trans-frontier road is free of *likin* and local tolls, and subject only to a regular Customs due. There is also a member of the China Inland Mission, that wonderful organization which has penetrated into every corner of the Chinese Empire, and which finds a never-failing supply of enthusiastic men and women to lay aside the calls of their native land and devote themselves wholeheartedly to the work in the interior of China. They are to be found in the most miserable cities and in the most obscure corners of the country, working quietly and unostentatiously always, but with unflagging courage. There seems to me little doubt that the cheery homes and self-sacrificing lives of our missionaries have been a very real object-lesson to the people among whom their lot is cast, and they have rendered very solid service to China by their efforts to direct her new educational adventures into clean and honest lines.

Têng-yüeh is the headquarters of a Taotai, who is responsible for peace and good order over the broad regions of the Western Marches, and his position is strengthened by a garrison both of the old Green Banner troops of China, and also of those new troops who have been drilled and armed in accordance with the most modern ideas of Europe or Japan. The Chinese officials live in Yamens within the city walls, and their lives are vastly dull—a veritable banishment from the lines of ordinary official life, with none of the music and theatricals, or the dainty and extraordinary dishes which are the heart's delight of Chinese epicures. For the white man, however, the Yun-nan country is full of attraction. The highland air is crisp and cold throughout the year, even during the rainy days of summer. One can gallop over the downs, shoot pheasants, partridges and quail on the bracken-covered hills, bringing down an occasional Lady Amherst or a silver pheasant to crown the bag. Woodcock, snipe, and wild-fowl lure one through the woods and marshes in the evening light, and the clear mountain torrents yield up the *Barbus tor*.

In spite of its far-away position, Têng-yüeh is the great market of Western Yun-nan, the distributing centre for foreign goods, the collecting centre for all the native produce coming down from Ta-li Fu. It is busy with Burma Caravans, its market thronged with tribesmen, and its streets gay with passing officials and their picturesque retinues, for it is in Têng-yüeh that the political and commercial life of the Yun-nan frontier finds its focus and its centre.

Frontier Tribes.—Let us consider for a little while the Chinese marches, the physical characteristics of the country around our north-east frontier; and the strange and little-known tribes which have been driven to the refuge of these border mountains, or have chosen the intervening valleys in the southerly march of humanity, since the Tibetan highlands and the Central Asian plains have grown less hospitable to man. Taking Sadiya as our first centre, we find to the north-west the Brahmaputra basin of Assam, with its line of tribes shut in among the rugged mountain country which is watered by the Bohroli, the Dihang, the Zayul, and the Lohit, and cut off from the probable line of Chinese progress from Rima towards Lhasa by the easterly arms of the Himalayan system. Of these tribes the Abors, the most northerly of all, have forced themselves most recently upon our attention by the murder of Noel Williamson and Dr. Gregorson, officers who had travelled widely in the tribal country and had met with a friendly reception on all sides. The Abors and Akas have long been known as warlike and independent peoples, with their own tribal organization and a plentiful supply of dhas and bows and arrows, but they have admitted our claims of suzerainty for many years, and their homes lie on the Indian side of Asia's greatest mountain boundary. The Daphlas, the Miris, the Mishmis, the Singphos or Kachins, and the Nagas all live within this Brahmaputra basin of Assam, and, though little touched by the direct administrative agencies of the Indian Government, they have been visited

from time to time by British officers and have acknowledged their Indian allegiance, whilst the difficult nature of their country and the lack of natural communications cut them off from the Chinese sphere in Tibet.

Leaving the Assam basin and moving further east, we find a different belt of country, where the easterly trend of the Himalayan system gives way to a series of parallel ranges cutting across it at right angles, and running in a regular grid-iron formation directly north and south. In the angle formed by these two mountain systems we find the actual geographical limits of India's north-east frontier.

High in the uplands of Central Asia rise three great rivers, the Salween, the Mekong, and the Yangtse, and, near the south-east corner of Tibet they run side by side within a belt of 50 miles, fed by few tributaries and divided by the great mountain masses which here and for many miles to the south have made the geography and history of the little-known and deeply interesting region marked out by nature as the Burma-China frontier.

In about lat. 28°, where the most easterly branch of the Himalayan system sweeps down towards the basins of the three rivers, we find that mysterious corner of the world where Tibet, India, and China meet. The line of snow-capped Himalayan peaks runs from the west towards the Salween, leaving Assam and Upper Burma to the south and Tibet to the north of the range. Then comes the right angle, while the unbroken limestone ridges of the Irrawady-Salween watershed divide the Chinese province of Yun-nan from the British outposts of Upper Burma. It is at this point, too, that China merges into Tibet, a line of semi-independent States with their hereditary princes and kings holding the balance between the rival powers of Lhasa and Peking, but gradually inclining to the Chinese dominion as the military and administrative forces of the Empire are pressed steadily westward.

The most northerly corner of Yun-nan, generally known as Yunnanese-Tibet, is actually a portion of the Tibetan province of Kham, long famous for its fighting men, and the race which inhabits the country is called Ku-tsung—men of Tibetan type and language, who have nevertheless abandoned to some extent their nomadic lives and now occupy themselves mainly with agriculture and cattle rearing. In the high plateaux of this district, lying at an altitude of some 11,000 feet, the Ku-tsung pass their lives in some prosperity, raising good crops and sturdy ponies and cattle that command a ready market both in Burma and Yun-nan. They are frank, cheery people, keen sportsmen and hunters, and they own a devout allegiance to those great Lamaseries, which, until the recent Chinese advance, have held the whole spiritual and most of the temporal power in the Tibetan borderlands.

For the moment that power is broken, and China has stepped in with beautifully worded edicts declaring the fostering love of the Emperor for his border peoples, whilst the presence of the Imperial forces gives a very

SHANS.

INDEPENDENT OR BLACK-BONED LOLOS.

THE TRANSFRONTIER WAY, INDIA TO TURKESTAN.

CASTLE OF TRIBAL PRINCE BETWEEN KASHMIR AND TURKESTAN.

solid backing to these expressions of benevolent intent. Many of the lamaseries now lie in ruins, their monks fled, their treasures scattered, and the tribesmen are exhorted to a new way of life, admonitions being even devoted to the advantages of wearing breeches by those who have omitted that simple expedient in the past. In the meanwhile Chinese settlers are being lured into the broad plateaux with promises of strong and handsome wives, of broad acres and countless yaks, thus repeating once more the process which has constantly carried the customs, the language, and the blood of the Chinese a little deeper into the country of the frontier tribes.

Whilst the purely Tibetan peoples still make their home in the most fertile and prosperous corner of the country, the basins of the three great rivers have each sheltered kindred though widely divergent tribes, and their inhospitable country and mountain fastnesses have enabled them to withstand the westerly progress of Chinese administration. Among these tribes the Lolos probably hold the strongest place, and though their scattered communities which have wandered south into Yun-nan tend to become absorbed in the Chinese cosmos, they still retain an unquestioned independence in the country of the upper Yangtse. Little is known of their history, and their own traditions speak of an ancestral nidus in the south-east corner of Tibet, where Burma and China meet. They are unusually tall and handsome, with well-marked noses and pointed chins, a higher type than is usual among the frontier tribes. It has been suggested to me by one who is an authority that they bear marked resemblances to the North American Indian, but though I can bear testimony to a striking physical likeness between the two types, I have had no opportunity of taking anthropometric measurements in Lolo-land, and can throw no light upon a question which might serve to link the plateaux of Central Asia with the plains of North America in the great book of the world's history.

The Lolos shave their heads, leaving one lock, which is bound into a turban and then twisted into a long horn projecting over their forehead, a very striking head-gear. The women are graceful in their carriage, independent and shy, but not unfriendly to foreigners; and I have travelled with a Lolo girl for guide, an experience which seemed strange after living among the pent-up women of China. Both men and women are often seen with a rough coat of untanned skins thrown over their shoulders, but the national dress is a long felt cloak, the women wearing a skirt beneath it, and ornaments of silver and shells. I remember once seeing an old chief in a long shapeless garment which was woven from asbestos strands. He was evidently pleased that his costume should meet with envious admiration, but he stoutly resisted all allurements of exchange, even though a much-coveted pair of corduroy breeches were thrown into the balance for him. I am inclined to think that the advantages of asbestos suitings have been somewhat overlooked in these days of expensive laundries.

It requires no washing, and is thoroughly cleaned by the simple process of throwing it into the fire.

Unlike the Kachins and Lisus, the Lolos have a written language. They have also a more definite idea in their religious aspirations, and have risen a step beyond the simple animism or nat-worship of the surrounding tribes in their conceptions of immortality and the life beyond the grave. They look to the starry heavens as the shadow of the life to come, and see in its shining constellations the souls of those happy comrades who have already passed beyond the veil.

Whilst thinking of the legends in which these young and half savage frontier tribes seek to explain the mysteries of nature and the secrets of the supernatural world, one is reminded of the old flood story, which, with little variation, finds a place in the folklore of them all. It is based always on the escape from the waters of a brother and a sister, who became the father and mother of the world, and recalls to us Ovid's "*O soror, o conjunx, o femina sola superstes*," though the Deucalion and Pyrrha of the frontier lands were not wedded until after the flood days were past. In the Lolo story the brother and sister were carried over the face of the waters in a wooden casket, and the first sign of the receding flood was a spray of bamboo, which sprang from a rocky crevice as the first sign of hope, and became for them the emblem of regeneration for all time. The Kachin couple were saved in a drum, the Lisus in a gourd, whilst in each case they bore sons, to whom are traced the families and tribes and nations which people the earth to-day.

Of all the tribes the Lolos have given the most trouble to the Chinese officials and people on their marches, for, not confining themselves to a steady opposition to administration or absorption, they make regular raids on their peaceful neighbours for their supplies of salt, and they seldom return without booty and cattle and prisoners; nor is it often that these men can be redeemed from slavery. A line of Chinese garrisons now encircles the independent Lolo country, but they do not penetrate or interfere, and are mainly occupied with hemming in the tribesmen within their own borders. In one city they have arranged a system of Lolo hostages, who are changed year by year, but whose lives would pay the forfeit in the event of aggression on the part of their unruly kinsmen.

There is another tribe, the Lisus, who are as wild and independent as the Lolos, but who are so shut in by their encircling mountains that the Chinese have made little effort to interfere in their affairs, and have left them unmolested in the inhospitable defiles of the upper Salween. Though of a lower type and lower in the scale of civilization than the Lolos, these Lisu peoples have a great interest for us, holding as they do an undisputed sway along the stretch of our north-eastern frontier between lats. 26° 30′, and 27° 30′, with the mountains of the Salween-Mekong divide shutting them off from Chinese power, and the ridges of the Salween-Irrawady watershed making a formidable barrier between them and the

Maru and Kachin tribes, who inhabit the Nmai Kha and Mali Hka valleys of Upper Burma among the upper waters of the Irrawady basin.*

To the south of the Tibetans, the Lolos, and the Lisus a chain of rice-growing valleys stretches down as far as the Mekong and the French frontiers of Tonking. The wild Was, the Lahu or Lohei, the Palaungs, and the Akkas are all found in the mountains which fringe them, but the valley population is almost entirely Shan. They are to be found in every stage of political evolution, from those of Chen-kang near the Kunlong Ferry, which has been entirely absorbed by the Chinese, to the Sip Song Panna or Twelve Shan States in the extreme south of the province. Until about a year ago these little states enjoyed an absolute and very riotous independence, but they have suddenly been occupied by Chinese troops, and taught a severe lesson. In spite of the tropical heat and the fever-stricken valleys, the Chinese troops have remained throughout the summer, and there seems little doubt that the Yun-nan authorities are earnest in their resolve to carry their administration up to the very border-line where they are bounded by foreign frontiers.

It will be realized, then, that along the whole of our North-East Frontier we march with country over which a suzerainty is claimed by China. The Chinese are separated from us only by a fringe of aboriginal races, sometimes with a history of actual independence as in the case of Tibet, sometimes with little more than the tradition of it as amongst the Shans, or again with the independence only of inhospitable mountain homes such as those of the Kachins, the Lolos, the Was, and the Lisu. The Chinese policy in dealing with these tribesmen is one of peaceful absorption, and they spread their influence a little year by year, first robing the chiefs in Chinese official dress with its accompanying hat and peacock feather, bestowing on them an hereditary title and a Chinese seal, then insisting on a slight knowledge of the Chinese tongue. Their influence is light, intangible, and unostentatious, but none the less real, and an erring Sawbwa or chief soon realizes the weight of displeasure which his superintending officer can wield. When disorders or disobedience go beyond the recognized limit soldiers appear and annexation takes place, a fate which has already befallen two of the Shan States, and which may be anticipated for others in the near future. From the north to the south of Yunnan the Chinese have shown a definite progress during the past two years, both in the Shan States and in the tribal country. An Imperial Commissioner of viceregal rank has been appointed "Warden of the Marches" for Yun-nan and Se-chuan; civil and military officers are being posted throughout the States, a census is being taken, a basis of taxation laid down, schools are being established, and the Chinese language enforced. They

* "The Reaches of the Upper Salween," by Archibald Rose, F.R.G.S., *Geographical Journal*, 1909, vol. **34**, p. 608. "Lisu (Yawyin) Tribes of the Burma-China Frontier," by Archibald Rose, F.R.G.S., and J. Coggin-Brown, in the *Memoirs of the Asiatic Society of Bengal*, vol. **3**, No. 4, 1910.

have tried, too, the difficult experiment of introducing the cold-blooded and stereotyped marriage customs of China amongst these highland peoples, who, though far from immodest, are attracted by hot-blooded adventure as much in their loves as in their wars. It is clear indeed that the Chinese are determined to extend their administrative area, until they are met by the outposts of their neighbours along the whole of their Central Asian border-line.

Frontier Camps and Frontier Journeys.

For those who are able to follow the main trade routes of the empire it is possible to travel throughout the length and breadth of China without even carrying a tent, and needing but little baggage save a camp bed and such stores as may be necessary to relieve the monotony of local chickens and rice. Every stage has an inn, a dirty, fly-infested place, with a table and two chairs, bitterly cold in the winter, and as unbearably hot in the summer months. In the thinly populated lands of Yun-nan, however, there are few inns and few supplies, and it is only during the last year that rest-houses have been erected even on the main highway from Bhamo up to Têng-yüeh. Frontier journeys are therefore a slow progress, with a long caravan of mules and a camp at night by the waters of some clear mountain stream.

We have followed the tribes and the line of country from north to south on the Chinese side of the Burma-China frontier, and I would ask you to come with me now across to the British side. Within that mountain angle at the extreme north-east corner of our Indian Empire lies a tract of country which both Great Britain and China have been content to leave almost unknown in the past, but to which attention has recently been attracted in consequence of the steady advance of Chinese colonists into the basin of the Irrawady. The Hpimaw expedition, a small column from the Burma post at Myitkyina, has visited the territory during the past few months for purposes of exploration and administration, and they found themselves in extraordinarily difficult country. They tell of marches from dawn till dark when only 2 to 3 miles were covered, and on one occasion it took eleven days to cover 23 miles. In spite of the natural difficulties, however, the expedition did some excellent work, and a road has been pushed northward for 140 miles from Myitkyina, thus carrying our administrative belt right up to the Chinese frontier.

About a year ago I made a hurried march into this country as far as Hpimaw, or Pien-ma as the Chinese call it, and it may interest you to trace for a few minutes the course of my journey in the border country.

From Têng-yüeh the road runs north along one of the little parallel valleys that lead to the dividing range between the river systems of the Chinese Salween and the Burma Irrawady. We are soon beyond the belt of cultivation and bare, treeless hills into the land of the Lisu cross-bowmen, where the masses of limestone cliff rise from the pines and evergreens

THE FRONTIER MOUNTAINS, IRRAWADY-SALWEEN DIVIDE.

LISUS OF UPPER SALWEEN.

LASHI KACHIN.

WILD MARUS.

of forest-clad slopes, the foaming torrent of the Mingkuang stream winds a white course through the bracken, the calls of pheasant, sambur, and barking deer break the silence of the morning, and rhododendrons, briar roses, and pyrus japonica gleam out with a wonderful brilliancy of colour from the grey mists that herald the coming rains. Even the Chinese escort, and the phlegmatic muleteers are moved to wonder at the beauty of the land. They are good fellows, these Chinese soldiers of the Green Banner troops or old army, always cheery and uncomplaining even on the hardest days, dressed in serviceable blue nankeen with turbans and straw sandals, and able to do long and continuous marches of from 25 to 30 miles a day over those rough mountain tracks. They manage to live, too, on the resources of the country, and scarcely ever need any transport or commissariat beyond the one blanket which a generous Government provides. The Chinese have borrowed from us the fashion of recruiting a percentage of tribesmen for the regiments stationed on the border, and on this journey I had one Kachin lad, on whom descended the dignity of carrying my gun in addition to his dha and his embroidered bag, with its bamboo tube of liquor.

I asked him one day how much spirit was considered a proper daily allowance among the Lashi tribe, to which he had the honour to belong. "That," he replied, "is regulated entirely by the amount which we are able to obtain." "Tell me," I said, "what is the song you sing?" "That," he answered, "varies with the occasion. I sing now that the dawn is greying in the sky, and we must take the road; from the mountains comes the cry of the deer, seeking their mates in the spring; the flowers are beckoning to the bees, all the world is glad, and only I lament, for in my tube there is no wine to cheer my heart."

The fifth day's march brought us to the end of the valley at Ta-chu-pa, where a scattered population of eighty Lisu families eke out a scanty subsistence, and five strongly stockaded Chinese houses form the headquarters of a thriving trade in coffin planks that come from the forests beyond the range. Here we were at the foot of one of those wild passes that would lead us from Yun-nan into the unadministered territory of Burma, and we halted for a day to make some preparation for the crossing of the range. The account of the road given by the tribesmen was not very encouraging, and there was no alternative but to jettison the escort and the mule-caravan, and to send them round to meet us when we emerged again into open country. I managed, however, to enlist a few young Lisus as porters, and they undertook to carry enough kit for ten days for myself and my personal servants. There was little enthusiasm for the journey, and it was difficult to decide who felt the more aggrieved, the escort, who were "being deserted" and left to face the terrors of the road alone, or the men who were to accompany me into the "inner land," relying on the protection of a shot-gun and varied samples of the British and foreign pharmacopœia. For future travellers on the North-East

Frontier, I can recommend a medicine chest as an unfailing passport to the affections of the tribesmen. There is a steady demand for remedies, and, even if physical relief does not always follow the direct line indicated in the book of the words, the application of draughts and pills and lotions ensures a mental gratification which is nobly independent of results. I remember one old chieftainess who was totally blind, but who felt that she ought to be cured. Needless to say, my efforts were all in vain, but her heart was completely captured by a liberal application of scented hazeline to her eyes and nose and face! The cotton-wool with which the applications were made grew noticeably blacker, and at the end of the treatment her complexion and general appearance presented such a marked improvement that every feminine member of the encampment developed an affection of the eyes; nor was there any rest until my stock of hazeline had been exhausted.

And so we commenced the ascent of the watershed range, the track lying through miles of tangled bamboo brake and dense forest jungle, through which an advance-guard of Lisus and Lashis hewed a way with their dhas, whilst the ponies struggled and slipped on the steep mountain paths, scrambling over the trunks of great fallen trees, and wading through the rocky torrents. This track is regularly used for a few months of the year by the tribesmen who come carrying coffin planks down to Mingkuang and the Chinese markets; but their path was scarcely discernible in the jungle, and the heavy rains which had fallen for several weeks had made of the low-lying portions a hopeless morass. After a long climb we reached the pass of Fen-shui Ling, the "Dividing of the Waters," and it was very reassuring to learn how thoroughly the tribesmen had mastered the principles of physical geography. Pointing to two little streams which trickled in opposite directions down the mountain-sides, they explained that the water-parting formed the border-line between Great Britain and China. They gave me, indeed, such an insight into the practical meaning of a "divide" as might have proved a liberal education to those distinguished officers of a friendly Government, who once gravely stated that a disputed frontier watershed would be found upon investigation to lie at the *foot*, and not along the top of the neighbouring mountain range. And then, with a courtesy that went to the heart of the situation, the Lisus from the Chinese side handed me over to the Lashis as their guest, and we continued our journey down into the valley of the Ngawchang Kha. On arrival at the next camp the weather broke, and for five days and nights the rain poured down in ceaseless torrents. The little single-fly tents could not resist the storm, clothes and bedding were sodden, the weight of the porters' loads was terribly increased, and the poor fellows spent the night squeezed within the narrow limits of the tents as far as was physically possible, or out in the open with no protection from the wet ground or the beating rain and snow save a layer of palm fibre. After seeing the hard lives that these tribesmen lead, and the triumph of the elements in their

mountain homes, one wonders little at the animism forming the basis of all their faith, or at the fact that the rain and thunder, the lightning, the wind, the forest, and the mountains are all held by demons of malice, whose wrath can only be appeased by offerings and sacrifice. On one day we were obliged to march from dawn to dark without a halt for rest or food, as we found no clearing in the jungle, and the country was reported by the natives to be full of poisonous herbs, which the ponies would eat if we halted, with fatal results. It was with some relief, then, that we at last saw a cluster of homesteads on a distant hillside, and knew that Pien-ma was near, and the worst of the journey past.

We were now in that broad stretch of territory to the extreme north of Burma and beyond the Myitkyina outposts, which until the last year has been practically unadministered by Great Britain, as large neighbouring tracts on the other side of the range, including the whole of the Black Lisu country in the valley of the Salween, remain unadministered by China. It is the old story, however, of the white man's burden, and these outlying peoples are gradually being brought under control by the extension of that orderly government and honest administration which has already found a practical justification in the health and prosperity and general well-being which it has brought to the tribes farther south.

Before leaving this country, it may be interesting to seek for some general idea of this extreme north-east corner of our Indian frontier, as it has been revealed by those few travellers who have penetrated into the unadministered territory. They include Errol Gray, in 1892, Woodthorpe and Macgregor, in 1895, Pottinger in 1897, and Noel Williamson in 1907, all of whom entered the country from the Indian side. Prince Henry of Orleans in 1895, and Young in 1905, made remarkable journeys in the opposite direction through from China into Assam. Mr. H. F. Hertz, C.I.E., and Mr. W. A. Hertz, C.S.I., now Deputy Commissioner at Myitkyina, have also penetrated far into the territory ; but their attention has been devoted to the administrative problems and the future of the people, and their work is too broad to be touched upon in this light geographical summary.

The country is drained in its eastern corner by the headwaters of the Irrawady, which, at the confluence above Myitkyina, splits into two streams, the Nmai Hka and the Mali Hka. On the west the Chindwin—another tributary of the Irrawady—flows down from the Naga hills of Assam and through the Hukong valley, eventually joining the parent stream not far from Mandalay. Then on the north, the Lohit and Dihing branches of the Brahmaputra run from the isolated Shan State of Hkamti Long westward to Assam and Sadiya. On the eastern boundary of this country lies one of the world's great ranges, the Irrawady-Salween watershed, which divides the territory from the Chinese province of Yun-nan. On the north rises a range which shuts it off from Tibet, and which appears to be one of the most easterly arms of the Himalayan system.

The fact remains that this distant and partially administered corner

of the old Burmese kingdom is closed from China to the north and east by a great mountain wall, which compares not unfavourably with the barriers of India's North-West Frontier. Its rivers are a part of the Indian system. Its people belong to the tribes of Assam and Burma already under direct British administration, and ethnologically distinct from the Tibetan and Lisu tribes who inhabit the Chinese slopes of the surrounding mountain systems.

The northern belt of the territory, stretching away from the Mishmi or Taroan country of Assam, is a huge stretch of uninhabited jungle, subject to a heavy rainfall, and marked only by the ruins of ancient villages, showing the existence of some old-time trade-route between Assam and the Shan State of Hkamti Long, which still flourishes around the sources of the Mali Hka river under a number of princes or chiefs, who hold the title of Sawbwa common to all the Shan States.

For centuries past the Sawbwas have been subject to Burma, holding their rank and titles from the Court at Mandalay and retaining to this day their ancient insignia of office. Some twenty years ago, when Upper Burma was definitely enrolled as part of the British Empire, they applied for, and received, a renewal of their appointments from the nearest centre of British administration, and communications have constantly been maintained between Hkamti and the district headquarters at Myitkyina. Forming as it does a political, historical, and commercial link between the administrative areas of Upper Burma and Assam, and guarding as it does the sources of the Irrawady, it would be impossible to allow any interference with the Burma traditions of this Hkamti State, or to permit any Chinese aggression from the side of Yunnan or Tibet. The gradual improvement of the roads and communications in the country north of Myitkyina will now give opportunities for a fuller development of the fertile Hkamti valleys. There can be little doubt indeed that the inclusion within the administrative area of these temperate highlands, their tea hills, and their open grazing country will prove of very material value as a hinterland to the tropical river valleys of lower Burma.

Away east of Hkamti and between it and China is the rugged country known as the Kiu valley, which was traversed by Prince Henry of Orleans in 1895. It is inhabited by Kiu-Tzu or Khunnongs, who are in a low state of civilization and who add to their scanty resources by acting as labourers and porters for their wealthier neighbours of Hkamti. There seems to be evidence, too, of a wilder, fiercer race known as Chenungs, with homes in the corner between the upper Nmai Hka and the Salween.

Descending the Mali Hka river we find the early home of the Kachins and the path by which they found their way south. A number of them, known as Khakus, still dwell on the river banks and pass their lives in considerable comfort and prosperity. Unlike the turbulent streams to the east, the Mali Hka runs placidly over its sandy bed, bordered by a rich tropical vegetation similar to that of Assam, out of which rise numerous

villages with a flourishing agriculture and united by good roads. The Kachins inhabiting the Hukong valley to the west of the Mali Hka are also wealthier and more prosperous than their highland cousins in the south. They have driven out the early Shan inhabitants, as their kinsmen now threaten to do in their more southerly settlements, and they have settled here to a regular lowland life, producing quantities of rubber and amber, which find an exit through the markets of Myitkyina.

The Nmai Hka valley to the east belongs to the wilder section of the frontier lands, and formed the route by which the Marus descended in their march towards a land of promise, when emigrating from their northern homes. In the upper reaches of the river they still remain the dominant race, and Pottinger has described them as the "Black Marus" on account of their dark complexions, an attribute which may be traced in all probability to their disregard of personal cleanliness. The independent Lisus are also classed as "Black" by their neighbours, and they probably deserve the name both by virtue of their appearance and their deeds. A lad who had been in captivity among them for some months told me after his escape that "they have no lamps or candles, and at night the men sit round the fires, smearing their faces with lard and ashes, drinking deeply of their rice spirit, and for ever plotting robbery and murder." In the lower reaches of the Nmai Hka and in the valleys of its affluent the Ngawchang Hka, the inhabitants call themselves Lashis, though they are undoubtedly related not only to the Marus of the upper river, but also to the Szi tribes, who are found farther south along the Burma-China border. They are wild-looking fellows in their long, unbleached hempen robes and gaiters, and they are never seen without their dhas and spears. The women have generally adopted blue Chinese cloth for their clothes, with short skirts and turbans, and coils of cowries and beads round their waists and necks, their ears being pierced in three places for large brass or silver hoops. The Lashis attend no market, and depend on Chinese pedlars for their clothes. They are indomitable traders, these Chinese, reaching into the farthest corners of all that tract of country, bringing in their cotton stuffs and their ornaments, opium, beads, buttons, needles, and oxen, and carrying out in exchange gold, musk, bears' galls, a drug called huang-lien, bees'-wax and coffin planks. The imports nowadays are entirely of Chinese origin, but the roads now being pushed out into the country should succeed in carrying British cotton goods all through this district. It is sufficiently populous and prosperous to absorb a considerable quantity of such goods, for the natives can produce no local garments beyond the rough hemp of their village looms.

For some days I was hemmed into this remote corner of Upper Burma by violent storms. The wind howled over the bare hills, the ground became a regular quagmire, and the passes were all blocked by snow. Towards the end of April, however, I managed to get away, and struck eastwards over a pass, which crosses the Salween-Irrawady divide and enters China

near the little hamlet of Teng-keng on the Salween, the capital of one of those hereditary Tussu or chiefs, who are charged by the Chinese with the care of the Lisu country, but who dare not show their face anywhere near the villages of the independent tribesmen. The top of the pass (10,500 feet) was covered in whirling mist-wreaths, and at intervals could be seen miles of snow-clad peaks stretching far away in a long unbroken line, as the great mass of the Irrawady-Salween watershed vanished into the white clouds towards the north. All round the pass were masses of primulas, great blooms of a brilliant azure blue, and to the east the valley of the Kutan Ho ran steeply down in sunshine to Teng-keng and the Salween river, backed by the great mountain range dividing it from the Mekong, which is almost as perfect and symmetrical as are the peaks on its western bank.

The weather fortunately cleared for my march back to Têng-yüeh along the Salween. The river valley was in its full glory of early summer, and, although intensely hot, was a pleasant change after the hard journey in the mountains. These upper reaches of the Salween are the home of the Lisu tribesmen, who have up to the present successfully resisted every attempt at administrative advances on the part of the Chinese. As far as lat. 26° 15′ they are comparatively quiet, passing lean and hungry lives in their mountain villages and attracting little attention. Beyond that point, however, and as far north as about lat. 27° 40′, where the river opens out and the Lisus are replaced by the milder Lutzu tribe, they hold undisputed possession of jungle-covered gorges, recognizing no form of law or government, and maintaining a seclusion which has only been broken by the late Mr. Litton and his companion, Mr. Forrest, in 1905. Further explorations of the Salween have been discouraged by the murder of Dr. Brunhuber and Mr. Schmitz in 1909. Looking up that rocky gorge, one could well imagine the scenes so vividly described by Litton, the filthy villages where every man's hand is against his neighbour; the poverty, the hunger, the cross-bows, and the poisoned arrows, the single-rope bridges across the torrent, and the diet of wild honey that proved at last so nauseating to the weary travellers.

The Kashmir-Kashgar Frontier.

In the extreme North of India and far removed from the jungles of Burma and Assam there stretches another section of our Chinese frontier, where Kashmir marches with Turkestan, or the New Dominion, and the district generally known as Kashgaria. Here, among the untrodden snows of the Himalayas and the Hindu Kush, runs the boundary line which divides India from the Pamirs and the Central Asian deserts, and here lies the point where Great Britain and Russia and China, the three forces of the Asiatic continent, find their common meeting-place.

The military road which runs from the Wular lake in Kashmir to Gilgit, through thirteen stages of wild and beautiful scenery, is well

known and has been frequently traversed and described. It is continued for four marches beyond Gilgit, and leads as far as the little states of Hunza and Nagar, the centre of a tribal organization no less interesting than that of the north-east frontier, though entirely different in character. The Kanjutis of Hunza and Nagar made a desperate struggle for independence when we advanced into their country twenty years ago, but their career of lawlessness and bloodshed became at last unbearable.

It became evident that there would be no peace in northern Kashmir till we had dominated the whole country as far as the Hindu Kush, and carried the Pax Britannica right up to Nature's frontier. The whole history of Central Asia indeed is an object-lesson in that strange fate which presses nations forward, often against their will, and imposes upon them ever-increasing burdens. Civilization has no place for the lawless tribal fringe, and it must sooner or later be broken or dominated, a task which has occupied the energies and moulded the policies not only of England, but of Russia also and China. They have met now in a common goal with the best and surest of frontiers, the watershed that sweeps across a continent and has bounded the ambitions of man from the beginnings of time. It is difficult to realize what it all means until one wanders through Central Asia, alone and unarmed, in places where within the memory of living men, defenceless travellers had learned to expect a cruel and certain death. One realizes then that though old conditions may have fostered a bolder spirit in many a gallant tribesman, yet for the world at large the change has been all gain. England and Russia and China have worked hand in hand in this towards the greatest good of all, and now at last that old trade route which led from Rome across to China is once more open to peaceful caravans, once more protected by great imperial powers, and free at last from its long eclipse under the hands of nomad hordes and lawless mountain princes.

But even when we have reached the fastnesses of Hunza and Nagar, we are still seven days from the actual frontier, and the most difficult and dangerous marches of all this journey lie ahead. During these last marches to the frontier ridge all but the slightest kit must be abandoned. It is a slow and anxious progress along the cliffside, scaling precipitous rock-faces with but a few inches of foothold, crossing logs which are balanced in the crevices, so frail and so inconsequent that an unsteady stone, a slipping plank, or a false step would throw one hundreds of feet to the rocks of the river-bed below. The way lies, too, across a glacier, which, with its ice-peaks separated by deep cracks and chasms, made the most formidable obstacle of all under the heat of the August sun. Such is the road which leads from India to Chinese Turkestan and the Russian outposts in Central Asia, a road which divides our Indian Empire from its northern neighbours rather than links it with them. And so one comes to the great watershed, the meeting of the Himalayas and the Hindu Kush, and the Kilik and Mintaka passes lead across to Chinese Turkestan.

There is another road from Kashmir into Chinese territory—a longer but less difficult one—from Leh northward across the Karakorum. It is the loftiest trade-route in the world, the pass itself being over 18,000 feet; but caravans labour across it year by year, sacrificing vast numbers of transport animals to the strain of the high altitude, the storms, the cold, and those 200 miles of desolation that mark the Karakorum plateau, "The Desert of Black Gravel."

But to return to the Kilik pass, the climb leading up to the roof of the world at a point where, in the words of Sir Thomas Holdich, "a rugged and inaccessible spur of the Sarikol range carries the boundary into regions of perpetual ice and snow to its junction with the main range. Here, amidst a solitary wilderness, 20,000 feet above sea-level, absolutely inaccessible to man, and within the ken of no living creature except the Pamir eagles, the three empires actually meet." From the frontier as far as Tashkurgan, stretches the Tagdumbash Pamir, a part of Sarikol, and its people are believed to be of Aryan origin. In the broken mountain country north of Tashkurgan one finds the Kirghiz, nomads too, but of a more Mongolian type, with little hair upon their faces and long narrow eyes. These races of Central Asia, however, are greatly mixed in blood, and one may find in the same tent a black bushy beard alongside a smooth-faced lad with flaxen hair and well-opened grey eyes. Kirghiz, or Sarikoli, or Turkoman, however, all bear the distinctive marks of the nomad above all difference of locality or race or creed. The guest is received into the tents of the Kirghiz Mohammedans, welcomed as warmly at their fireside, and waited on as freely by their unveiled women as among the Buddhist Mongols of Northern Asia. They are a picturesque crowd as they sit round the argol fire waiting for their evening meal; the nomads in robes of every brilliant hue, orange, and purple, and crimson, and green; my Kanjutis from over the border in their white cloaks and caps, with bunches of yellow poppies or mauve primulas above their curls. All round us are the flocks and herds, shaggy black yaks and two-humped camels, the men and children rounding up the cattle, the women milking or cooking or weaving, and the sun throwing its last gleams over the brown tents and the broad russet pastures in their setting of eternal snows. One is carried back to the days of Father Abraham and Father Isaac, to those far-off centuries when these central Asian plateaux swarmed with countless wanderers, who were driven out at last by the resistless forces of drought and famine, and went forth to conquer the known world, to overwhelm the nations with the Tartar wave of the Dark Ages, and to leave their mark upon their peoples from Russia to Japan.

China's hold upon her nomad population is of the lightest and, although a handful of men is maintained on the Pamirs at Tashkurgan, there is little sign of Chinese authority until one drops into the great plain of Central Asia, and finds at Kashgar a Chinese Taotai, a garrison, and a walled city

on the regular Chinese model, set in that green ribbon where the line of irrigation brings wealth and prosperity and the most luscious of fruits to a dense Mohammedan population, on the very borders of the deserts of Takla Makan. Here we find the Chinese in their furthest outpost, their westernmost extremity, a position which they have lost and won time after time throughout the ages. Here they are installed as rulers of an alien race, surrounded by Mohammedans, a five months' journey from Peking, yet utterly unaffected by their strange surroundings and unusual conditions. They do not even attempt to learn the language of the people, and remain entirely dependent upon their Turki and Persian interpreters. They have even a separate city for themselves, a Chinese Kashgar lying several miles from the Mohammedan town, both of them provided with fine walls and guard towers and moats.

From Kashgar lines of cultivation and traffic stretch eastward to China proper on either side of the great desert, the northern ones leading past Urumchi into Mongolia and Kansuh, that to the south passing by the ancient civilizations of Kotan and the Lob basin. Changes of climate have deflected the line of the road since classic days, and even since the time of Marco Polo, but the great trade route is still open, the long lines of camels still swing through the dusk on their night marches through the desert, bearing their distant cargoes from Peking or Samarkand, from the oil wells of Baku and the Moscow cotton factories. Here in Kashgar one realizes what the central Asian markets meant to the ancient world and what they mean to-day. Here are still the nomads of the high plateaux, the thronging Turkomans of the fertile oases, the old means of transport, the richly laden caravans, the mud-walled caravanserais, the very heart of Asia. And here at last one turns one's face westward, following that old path of conquest and progress and commerce across the desert and over the Alai snows, through Samarkand and Bokhara, over the waters of the Oxus, through country still rich in memories of Alexander and Genghiz Khan and Tamerlane, and then at last to Geok Tepe marking the last wave of conquest, Russia's final and decisive victory, till one reaches the Caspian, the Caucasus and Constantinople, and the long, slow marches of Asia give place at last to Europe.

The Chinese as Frontiersmen.

Throughout all those earliest centuries of the Christian era, when China was struggling to consolidate an empire around the Yellow river and Yangtse basins, her statesmen and her soldiers never ceased to dream Imperial dreams and to carry the fame of the dragon throne ever further toward the west. So early as B.C. 110 the Han dynasty had pushed Chinese influence as far as Kashgar, where a flourishing market sprang up for the exchange of commodities between China and the Roman Empire of the East. They had even built the Great Wall westward from Peking, which protected the whole of their northern frontier and kept open that road

into the Tarim basin, of which we have lately heard such interesting detail from the researches of Dr. Aurel Stein. The two thousand years which have passed, and which have seen such fluctuations in the decline and fall of China's glory, have left that old wall standing in the desert, its line still clearly marked, many of its watch-towers still standing, the manuscripts of the soldiers who guarded it preserved in the still dry soil, and the very foot-marks of its sentinels still outlined on the desert sand.

But Chinese influence in Central Asia was destined to no uninterrupted or peaceful career. In the eighth century the power of Islam swept over the land with its fierce struggles and hot religious passions, leaving to this day a Mohammadan faith throughout the country as far east as the Chinese province of Kansuh. For some two hundred years the Tang dynasty (618 to 908 A.D.) again brought to China a period of life and prosperity, one of the best eras indeed in her whole chequered history, and the more noticeable from the fact that it coincided with those dreary days of the Middle Ages, when Europe was passing through its darkest phase. The Tangs spread out their influence once more over the vast stretches of Central Asia, carrying their arms and their policies in a temporary triumph as far as the city of Kashgar. From that period there was a regular swing in the pendulum of Asiatic power, the influence of China rising and waning as the power on the throne proved vigorous or feeble. In the thirteenth century Genghiz Khan and his son the great Kublai not only conquered China, but brought to the Imperial throne a Mongol dominion stretching westward to Bokhara and Samarcand. Tamerlane followed him in 1333 A.D. with a series of Asiatic conquests, of which the fame rang through the western world, and left him with a reputation second only to that of Alexander the Great. With their usual foresight in such matters the Chinese laid claim to this young Turki conqueror and invested him with a fabulous Mongol descent. And so they continued the tradition of their Central Asian sway for many years after they had ceased to hold any power beyond the limits of the Middle Kingdom, at a time, indeed, when they were busy strengthening their barriers and shutting out the barbarian tribes which menaced their seclusion.

It was left to Chien Lung, the great Emperor of the Manchu dynasty, to consolidate the real hold of China over her outlying western dominions. In 1759 he definitely annexed Turkestan; invested many of the tribal chiefs along the Yun-nan and Se-chuan borders with Chinese seals and office; asserted a claim over Tibet, and appointed an Amban at Lhasa, after assisting the Tibetans against the inroads of their Gurkha neighbours. He even entered into relations with the neighbouring States of Bhutan and Nepal. His ambitions led him at last to attempt the conquest of Burma, but his armies were defeated, and neither he nor any other Chinese emperor has ever succeeded in extending their influence over that fertile land. Since Chien Lung's reign the power of China on these frontiers has been twice shattered by Mohammedan rebellions, that of Yakub Beg in

Turkestan lasting for fifteen years (from 1863 until 1877), whilst some forty years ago a similar rising generally known as the "Panthay Rebellion" devastated the province of Yun-nan during the eighteen years from 1855 to 1873. The suppression of these Mohammedan movements, however, left China more vigorous than before, and she spared no pains to consolidate her forces, and to bring her outlying dominions under direct and definite administration. In 1878 the whole of Turkestan was enrolled as a regular Chinese province, governed by Chinese officials from the capital of Urumtsi (Ti-Hua Fu), and her civil power is backed by a force of 8000 men, some of whom are drilled and armed on the lines of modern European armies.

It is, then, to the days of Chien Lung that China's modern land frontier can generally be traced. During the hundred years which elapsed after the death of this emperor there was little activity in these regions. The energies of her Government were being devoted then to the suppression of internal risings, and to the new questions which were arising on her seaboard in consequence of the breaking down of her old seclusive barriers and the opening of her shores to a world-wide trade. During the last decade, however, those landward frontier problems have again been forced to the front, and we have not been allowed to forget the presence of our Chinese neighbour on India's north-east frontier. The history of our relations with China in Tibet, and of the causes which led to the expedition to Lhasa of 1904, have been fully told in Sir Francis Younghusband's latest book, and there will be no need for me to dwell upon this section of the North-East Frontier.

Along the whole western border of Se-chuan and Yun-nan runs a line of tribal country, to parts of which reference has already been made, and which now constitutes one of China's most difficult frontier problems. Starting from the north of Se-chuan and running well down into Yun-nan, we find the plateaux of the Tibetan nomads. The most northerly of them constitute the Chia-rung States, lying to the west of Sung-pan and Kuan-hsien in Se-chuan; then come the fighting Horba States, Chantui and Chagla, west of Ta-chien-lu; then Derge, Chamdo, and Draya, to the west of Batang, and Litang and Mili farther south, the three last being part of the province of Kham.

For some years the Chinese authorities of Se-chuan and Yun-nan have been working towards the subjugation of these little principalities, and recent events have forced their hands and compelled decisive action. Early in 1904 the Assistant Amban Feng, who had been appointed to Tibet, was murdered on his way when near Batang, and the whole of the Lama country was soon up in arms. The disturbances spread over a broad stretch of country, and even as far south as Tze-ku on the Mekong, where the Lamas burned the French Mission and murdered Father Dubernard, one of those brave French pioneers who had devoted the whole of his long life and high intellectual gifts to the service of the frontier

tribes, having left France when Napoleon III. was at the height of his power, and never returned. George Forrest, a young Englishman, nearly fell a victim to the fanatic followers of the Lamas at the same time, and he was hunted for a month over the Mekong-Salween divide, eventually escaping through Wei-hsi, where he arrived almost dead from starvation and exposure. The serious nature of this Lama rebellion, and the murder of so high an official as the Amban Feng, finally stirred the Chinese into action. Chao Erh-feng, a man of good repute for energy and honest service, was entrusted with the task, and in 1906 he set out for Ta-chien-lu, commencing the great work on the Tibetan border which is still being carried on. In 1908 the Chinese showed their appreciation of the importance of his work by bestowing on him a rank and title equal to that of the Resident at Lhasa, at the same time giving him the fullest powers for the entire subjugation of the Marches. The native rulers of Batang, Litang, and Hsiangcheng have all been deposed, and their offices abolished, the State of Derge has been absorbed, Chinese officials and troops are stationed at every important centre, and, whilst the power of the Lamas is practically broken, a regular system of Chinese administration is being introduced, with schools, roads, and telegraphs. In the meanwhile, the increasing prestige of the Government has brought a new confidence to the people and the traders, who are now freed from the old lamaist oppressions, the *ula* or supply of transport animals for officials by the people, the forced service, and all the evils attendant on a powerful and unprincipled priesthood.

From Batang the Amban Chao has constructed a military road as far as Derge, and thence he pressed on with his modern-drilled troops to Chamdo, the great market of eastern Tibet, and the most important place between Ta-chien-lu and Lhasa. The past three years, indeed, have shown a tireless energy on these Marches. The powers of the independent states have been broken one after the other. Chinese officials have replaced the kings, who have generally been pensioned off with a small military title. The influence of the Lamas is dead, their greatest Lamaseries destroyed, and, for the first time in history, Chinese power is effectually established on this road, which forms the great highway between Lhasa and the thoroughly administered province of Se-chuan. The importance of the subjugation of these states cannot be overlooked. They formed the great barrier between China and Lhasa, both from a strategic and political point of view, and the effectual absorption of Tibet would have been impossible as long as the road was blocked by these tribesmen, who belong to an obstinate fighting race, and among whom the Lamas could be trusted to maintain a steady opposition to Chinese interference. No sooner was the way clear to Lhasa than another road was pushed south to Yun-nan and A-tun-tze, thence west to Chamutong and Rima, where the latest of China's military posts has recently been established within two or three days' march from our territory in Assam. And so we are brought face to

face with the realities of the Chinese advance to the very limits of their political boundaries in this little-known corner of the Chinese-Indian borderland.

The Future of the Frontier.

Such then are the long land frontiers which divide the territories of China from our Indian Empire, and before closing my paper I will endeavour in a few words to sum up the present position on the frontier. On all sides are broad problems of exploration, the unknown reaches of the Brahmaputra, and the white patch on the map through which the Upper Salween flows. There are unclimbed mountain peaks with eternal snows within but a few miles of semi-tropical valleys, great rivers and broad deserts, grassy treeless plateaux and evergreen forests. And then there is the fringe of tribesmen from the Hunza Nagars to the Abors, the Tibetans to the Shans, sounding every note in the gamut of human development. Some can boast proud and ancient civilizations, some still remain in a state of primitive barbarism, yet all are merging into the two Empires to whom Fate has entrusted their welfare, and in whose hands lie their future government and administration; for there can be no stopping of the clock; the process of absorption is as inevitable and as unresting as the sun in its course. Perhaps it is this relentless force of Nature which has brought the question of the frontier so forcibly to our notice in the course of the past few years. China is awakening to her responsibilities as much as to her rights; she is founding an army, a representative government, a modern learning and a new press, and sometimes the times seem out of joint, the internal situation will not balance itself, the external situation becomes top-heavy, and then clouds gather on the frontier horizons. She has shown a wonderful skill in the peaceful absorption of some races, Marus and Lisus, Kachins and Shans having all been gathered at times without too much trouble into the family of the sons of Han. Now she is engaged with a new problem, with the absorption of the Tibetan peoples, and it may be that this will prove a more difficult task, for in the past there has been a tendency for Nature to assert herself in the opposite direction, and for the stronger personality of the Tibetan to engulf the emigrant Chinese. Perhaps this will prove an insuperable difficulty to China's new ambitions in Tibet. If so, it is difficult to know what will happen, for it is hardly possible that she can maintain a heavy expenditure for her military and administrative machinery on the Tibetan border for an indefinite time, and we have yet to learn if the bold spirit of the Tibetans will consent to a purely Chinese rule not backed by overwhelming forces. Be that as it may, the border problem remains the same. India and China must meet along some thousands of miles of frontier, and meet as neighbours, willing to work hand in hand towards the solution of those difficult border problems which beset them both, the administration of the tribes, the substitution

of justice, and law, and order, of well-protected trade and agricultural prosperity, for the feuds and individualism and poverty that have marked the tribal belt in the past.

India has held out the hand of friendship on all sides, has tried to carry into her Chinese relations that broad reasonableness without which nothing can be accomplished. The Chinese should prove the best of neighbours for us, and there is, I think, every reason to welcome their administrative advance, so long as it continues in a spirit of neighbourliness and good accord, laying aside small prejudices and striving for the greater good of all the frontier peoples. These Chinese have an undoubted liking for us, be they tribesmen or the real sons of Han, for they know that they may expect from the English fair treatment and just dealings, and in travelling through many provinces of China I have never once been met by a discourteous word or an unfriendly action from the people.

As there is no dream of aggression from the direction of India, so I believe that there need be no danger to us in the recent Chinese advance, no yellow peril on the Indian borderland. Events, however, are moving apace, and we are reminded of Lord Curzon's warning that "Frontiers are the razor's edge on which hang suspended the modern issues of peace or war, of life or death to nations." It may be hoped that China will realize the value of British friendship in her future ambitions as in her past sorrows, and that she will be willing to meet us in a fair and reasonable spirit on the far-reaching Indian frontiers of Yun-nan and Tibet.

The PRESIDENT (before the paper): The reader of the paper to-night, Mr. Archibald Rose, is going to lecture to us about the frontiers of China and Great Britain in Asia. Mr. Archibald Rose has spent the last twelve years in the Consular Service of Great Britain and China. He was in the siege of the Peking Legations, from which he emerged, I am glad to say, unscathed. He subsequently travelled in Mongolia, and then marched across China from Peking to Sechuan in 1902. He spent two years there, in the course of which he travelled over a great deal of Western China, and came in touch with the frontier problems of China and her relations with her far-Western dependencies. For the last three years Mr. Rose has been stationed as Consul at Tengyueh, on the Burma-China frontier, at a time when the expansion of China in a westerly direction has brought her administrative border to the natural but largely undelimited line which is actually the north-eastern frontier of India. He has had many opportunities of moving about, and of establishing friendly relations with the tribesmen who are wedged into the corner where Tibet and China meet. He has just returned home to this country, having travelled by way of India and Central Asia. Finally, I may add that he received a C.I.E. among the recent honours that were bestowed at the Durbar.

The PRESIDENT (after the paper): I might feel tempted to follow our lecturer this evening in his description of the interesting countries which he has visited, as illustrated by the admirable slides that he threw upon the screen, and which recall incidents that are indelibly fixed in my own memory. But I prefer to say a few words to you on the vastly more important subject which has been raised by his paper, and which he has treated not only with knowledge, but with discretion.

The most remarkable politico-geographical fact of the modern world is the degree to which, in Asia, and much more in Africa, frontiers are growing together, and parts of the world which have hitherto been remote and regarded as unapproachable, are falling under the influence of this or that great Power. "No man's lands" are rapidly disappearing. Independence is giving way to protectorates and spheres of influence. Boundaries which a few years ago were fluctuating, or traditional, or in some cases non-existent, are becoming fixed, regular, and defined. Probably within the lifetime of most of us within this room there will scarcely be a portion of the globe over which the flag of some substantial Power will not fly. Hitherto this process has been in the main due to the advance of great European Powers. In Asia, they have been Great Britain, Russia, and France. But the lecturer this evening has taken us, so to speak, into another world, and has exhibited to us for the first time, at any rate during the past century, China as a growing, a pushing, an advancing, even an aggressive Power. Now although, as he pointed out to us, there may have been evidences of such an inclination on the part of China at times in her past history, broadly speaking this is a new phenomenon that he has described. It is one which it is desirable that we in this country who are interested in our Eastern possessions should regard with a watchful, although certainly not with a jealous eye. Mr. Rose, in his paper as he has read it, and still more in the form in which it will be published, has taken us round the Indian frontier and shown us the different points at which we are already or presently will be in actual touch with China. On the west there is the common frontier of the Pamirs. Then there is the frontier beyond the Karakoram. Proceeding eastwards, we come to the points where Chinese territory abuts very closely upon the states of Nepal, Sikkim, and Bhutan. This brings us in contact with the Tibetan problem. Further east we come to the Chinese frontiers on the borders of Assam, and finally to the frontier of Burma and China in Yunnan. A few years ago over the whole of this stretch of territory there was a belt of petty states or wild tribesmen between these two great Powers. In the majority of places it still exists, but it is becoming contracted, and we have to face the fact that in a very short time it will in all probability disappear.

The two most conspicuous scenes of China's advance are in the first place Tibet, and secondly the Yunnan frontier. This is not the occasion on which it would be proper for me to make a speech about Tibet. But I greatly regret that China has been encouraged by our action or inaction to resume and tighten, I may even say to re-create, what was only a nominal suzerainty over Tibet; and I think it an unfortunate thing that when, owing to the success of Sir Francis Younghusband, the Tibetans had been left with so friendly a disposition towards ourselves, they should have been allowed once again to fall into a position of subjection, if not of servitude, to another Power. I pass on from that to the boundaries of Burma.

This is no new question, for during the whole time I was in India one of the minor problems that occupied my attention was the frontier question of China on the borders of Burma. Attempts at delimitation were proceeding throughout that period. There were, however, difficulties, because we had to deal with Chinese officials who were left to act much as they pleased—and who were usually aggressive and sometimes impossible. Again, troublesome incidents used to occur in the course of contact with the wild tribes, and I remember that two of our own officers were murdered. The Government of India always set before themselves that which I am sure they are pursuing at the present moment, namely, the desirability of fixing a boundary which should be identical with the physical watershed.

There is a third point on this frontier of which I will only say this, that I hope

that at no time will there be any misunderstanding about the fact that Nepal, Sikkim, and Bhutan are states which fall within the political frontier of India, and that in no circumstances whatsoever would any other Power be allowed to tamper with them.

In the concluding parts of his paper Mr. Rose spoke of the future that lies before us in those regions, and he employed terms with which I find myself in entire concurrence. I venture to lay down as a general proposition to guide us that it will be wise for our Government, wherever we can, to fix definite frontiers with China, and, as a necessary corollary, not to allow those frontiers when determined to be encroached upon or impaired. It does not necessarily follow, if you fix a frontier, that you need carry your administrative functions right up to it. It follows no more in the extreme north-east than in the extreme north-west, where, as you know, our administration in some cases stops far short of the boundary which is the line of political influence. Although I have often heard British and Indian Governments accused of aggressive designs, I have never yet myself met a Government which was anxious to extend its rule over turbulent mountain tribes, and I should say that all that we want in fixing a frontier is that it should be recognized and kept by the Power that is upon the other side, and that the tribes which lie upon our side, while recognizing our political influence, should refrain from intriguing across the border or from harrying those who are within our political boundary. Those are the general conditions that we endeavour to create upon the frontier, and I hope that a steady policy of delimitation will be pursued by those responsible during the years that lie before us.

I agree with the lecturer in saying there is no reason why there should be any quarrel between ourselves and the Chinese over these matters. The general temper of that people is affable. Their respect for the English is greater than that of any other foreign power. The surest way, however, to avoid a quarrel is to show decision and firmness in the early stages; to fix your frontier and make it quite clear that you will not allow it to be infringed.

Finally, Mr. Rose spoke in language of enthusiasm and also of some pathos about that band of young officers of whom he is one, and who have done and are doing such magnificent work on the borders of the Indian Empire. My spirit also thrills within me whenever I think of those men, and certainly I have never been more proud in my life than when in any capacity I have felt that I was leading or inspiring them to good work. Mr. Rose mentioned among them Mr. George Litton —a great loss to the Indian Empire—a man of fine character and eminent public service. I would go as far as to say that if I were asked at the present moment where is the finest work being done by Englishmen, I would not point to the British House of Commons, nor even to the cricket-field at Adelaide (although pretty good work is being done there), but I would look to the frontiers of the Indian Empire, and to the work that is being accomplished by Mr. Rose and people like him.

The last point that occurs to me is this—Can there be a greater mistake than to suppose that the work of exploration is over? Is it not quite clear, when you follow Mr. Rose's journeys, and still more when you study the map, that there are in those parts of Asia alone hundreds of thousands of square miles of interesting and unknown territory still waiting to be visited and explored? It is my conviction that there is enough work for travellers and explorers for the next hundred years to come. I believe myself that successive Presidents of the Geographical Society will, for the next fifty years at any rate, have the pleasure of handing our Medals to geographers whose services will be at least as great, if not perhaps as showy, as those who have received them in the past. And when these fifty years of

geographical exploration have come to an end, I think it will take the geographers of those days at least another hundred years to digest all that this country will have swallowed in the preceding century.

I will now ask Sir Francis Younghusband to say a few words, and before he rises may I take the opportunity of congratulating him on what I hope is a complete recovery from a very dangerous accident and a very serious operation.

Sir FRANCIS YOUNGHUSBAND: Mr. Rose, in the extremely interesting and valuable paper only a portion of which he has been able to read to us this evening, dwelt upon the great and impressive personality and vitality of the Chinese, and the whole of his paper was a practical illustration of the effects of the personality and vitality of this remarkable people. Wherever you see a Chinaman, you are always deeply impressed by the strength of his individuality. If you meet him on the far borders of his empire, in Turkestan, Mongolia, or Tibet, he is always precisely the same as he is at the heart of his empire, and with that strength of personality he impresses to a very remarkable extent those tribesmen and frontier people with whom he is brought in contact. The vitality of the race is equally remarkable. When I used to look at those thousands of Chinamen amongst whom I travelled, I was always noting to myself that there appeared to be a regular sea of latent possibilities in them. For years and years they remain perfectly calm, and not a ripple appears on the surface; yet you feel all the time that underneath this calm there are immense vital forces ready to break into operation at a moment's notice, and I think at the present time we are in the face of one of these convulsions which occasionally break forth from the Chinese millions. At these times they throw up some great personality, and in the case of Tibet in the few recent years we have seen that very remarkable man, Chao-erh-feng (who, I believe, has recently unfortunately been murdered), who certainly showed a very conspicuous ability, force of character, and energy, first in reasserting whatever Chinese influence there used to be over those semi-independent tribes between China and Tibet, and eventually in asserting a regular Chinese domination over Tibet itself.

Well, when there is on one side of this magnificent natural barrier of the Himalayas 400 millions of Chinese with all these latent possibilities in them, we on the other side who have in our charge 300 millions of another type of Asiatics must necessarily take the profoundest interest in that most conspicuous natural feature on the globe, the Himalayas, and the watershed which roughly forms the frontier, from where the three empires of Russia, China, and India meet for 3000 miles down to Burma. For myself personally I have always taken a very special interest in this frontier, firstly because I happen to have been born on it, and secondly because I have spent the best years of my life, first of all in exploring, and afterwards in conducting our relations with the various peoples who inhabit it on both sides. We have, I think, now acquired a very fair knowledge, from the political, military, and business point of view, of this frontier. We know pretty well the portions across which no human being can possibly pass; we know those other parts over which it is just possible to scramble; and we know those others, of which some very remarkable pictures were given by Mr. Rose, and where small forces can, with difficulty, pass along. We know also the caravan tracks. The barrier, though a great one, is not absolutely impregnable. From the Chinese side there has been from time to time incursions to the Indian side, and from the Indian side into the Chinese. But while we have this information on the military and political aspect, there is, as Lord Curzon has very justly remarked, a very great scope still for geographical exploration. Only last year Dr. Longstaff related to us how he had discovered a mountain which has proved to be 24,000 feet in height. All the tract

round the mountain, on the far side of the Karakoram range, at the source of the Oprang and Yarkand rivers, has still to be explored. There is also the great geographical problem of the junction of the Sangpo river and the Brahmaputra to be solved, and there is the further problem of the sources of the Salwin. For many years there is ample field for geographical exploration on the far frontiers of India.

Sir HERBERT THIRKELL WHITE: I am very glad to have your permission to say a few words this evening, for of the important part of the frontiers which Mr. Rose has so admirably described I have some recent knowledge. I was familiar with the Burmese frontier of China both before and after the establishment of the Consul-Generalship at Yunnan-fu and the Consulate at Tengyueh. And I gladly bear testimony to the great improvement that has been effected in our frontier relations, and to the loyal and capable assistance which we in Burma have always received from Mr. Rose and his distinguished predecessors, among whom I may mention Mr. Litton, whose premature death was a loss to the Empire, Mr. Wilton, Mr. Sly, and Mr. Ottewill. Although, of course, in no sense under the Government of India or the Government of Burma, advice and assistance have always been voluntarily and most readily given to us, and many measures of value to Burma have been initiated by the Consular officers. It is by their help that frontier disputes are now settled amicably at periodical meetings with Chinese officials. It was owing to their good offices that we were able to survey the projected line of railway from Bhamô to Tengyueh. And I venture to hazard the prophecy that this is the route by which some day Burma will be linked with China by rail. It is mainly due to the hearty co-operation with the Chinese frontier officers that our relations with the Chinese have of late years been exceedingly cordial and satisfactory. I am sure that this good tradition is being and will be maintained. Mr. Rose has given us a characteristically modest account of his journey to Pienma. It was a very hazardous and difficult journey, and it was of extreme value in connection with the settlement of our frontier on the north-east of Burma, which it is not desirable that I should more than mention. On the whole, during the twenty-six years that have elapsed since our occupation of Upper Burma we have found the Chinese good neighbours. Yunnanese particularly we welcome as settlers and traders. There is need, if I may discreetly say so, of constant and watchful care against attempts at encroachment, but so long as that care is duly exercised, so far as the Burmese portion is concerned the order and peace of our frontier will be maintained.

The PRESIDENT: We have here present one whom I think you would like to hear, Mr. Claude White, who is our greatest authority on that part of the Indian frontier which embraces Bhutan and Sikkim. He was in charge of our political dealings with those states at the time of the Tibetan campaign, and did more than anybody else to secure the happy relations that now unite us with the rulers of those states.

Mr. CLAUDE WHITE: I have not much to say on this subject. The only part of the frontier I know anything about is that of Sikkim and Bhutan, and in those two countries I had very few communications with Chinese officials, and had very little to do with the Chinese generally. As Lord Curzon said, these two countries must be, and always will be, I hope, quite distinct, and always be under the protection of the British Government, and not under that of China. I am also sorry that the Tibetans have been brought so much under the influence of the Chinese. Personally I should have liked to have seen them more independent, and, as Lord Curzon has said, more of a "buffer" state. The Bhutanese have taken up our side entirely, and there is no question of the Sikkimese. I believe the Chinese have made some

overtures to Bhutan and Nepal, which have been rejected by these states, and I am very glad they have been. The Chinese should not be allowed on the Indian side of the Himalayas.

The PRESIDENT: We will conclude with a vote of thanks to Mr. Rose for his excellent paper.

EXPLORATION IN THE ROCKY MOUNTAINS NORTH OF THE YELLOWHEAD PASS.*

By J. NORMAN COLLIE, Ph.D., LL.D., F.R.S., F.R.G.S., etc.

THE part of the Rocky mountains, that run north through what is now the Dominion of Canada, have only in the last twenty-five years been made accessible to the ordinary traveller. In 1886 the trans-continental railway, the Canadian Pacific Railway, was opened. Before that time it would have taken many months journeying across the prairie to reach even the outlying foothills, whilst from Vancouver on the Pacific it is impossible to say how long would have been spent fighting with the canyons of the West, that are filled often with the densest forest, and down which the waters of countless rivers run.

The history of this "Great Lone Land" is practically the history of the fur trade; of late years the prospector has wandered through many of the valleys leading up to the main chain, but still most of the country lying within 20 miles of the watershed is almost unknown. No human beings live there, Indians seldom penetrate into these mountain fastnesses, the land is deserted. It is not a country that appeals to the settler; narrow valleys filled with pine forests, with swamps or muskegs; rapid rivers, and not too much arable land; it would yield no crops, neither is there grass except in a few isolated spots. The snow, too, begins to lie in October, and it is not till the following May or June that it clears away.

The first man who crossed the continent in these latitudes was Sir Alexander Mackenzie in 1793; he crossed the mountains at the head-waters of the Peace river. From 1799–1814, Alexander Henry, one of the hunters of the North-West Company, kept a diary of his journeys in Western Canada;† in it one can find much information of the wild life of the pioneers of those days. During the same period David Thompson collected an immense amount of knowledge about the same districts. He discovered the source of the Columbia river; he was the first to cross the mountains by more than one pass; but his greatest achievement was "a Map of the North-West Territory of the Province of Canada." In 1809 Simon Fraser and Jules Quesnel explored the Fraser river to its mouth.

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* Royal Geographical Society, January 29, 1912. Map, p. 312.

† 'The Manuscript Journals of Alexander Henry, Fur-trader of the North-West Company, and of David Thompson, Official Geographer of the Same Company.' Edited by Elliott Coues. 3 vols. 1897.

Alexander Ross a few years later describes the life of the first settlers on the Columbia river in his book on 'The Fur-hunters of the Far West.'

From that time till 1858, when British Columbia passed out of the hands of the Hudson Bay Company and became a Crown Colony, few people visited these western valleys. In 1858 a great influx of miners took place into the Cariboo country in northern British Columbia; most of them, however, came north from California and the States, and so did not have to cross the Rocky mountains in Canada.

In 1857 Captain J. Palliser was sent out by the Government to explore "that part of British North America which lies between the northern branch of the river Saskatchewan and the frontier of the United States, and between the Red river and the Rocky mountains;" the Government also wanted information about passes over the mountains, and "wished him to ascertain whether any practical pass or passes, available for horses, existed across the Rocky mountains within British territory, and south of that known to exist between Mount Brown and Mount Hooker," *i.e.* the Athabasca pass. From the explorations of Dr. Hector and others working under Palliser, several passes over the mountains were discovered, but Palliser came to the conclusion that "a line of communication from Canada across the continent to the Pacific exclusively through British territory" was impracticable. In 1871 British Columbia entered the Dominion of Canada, and at once a survey was started for a trans-continental railway. It was amongst the Rocky mountains that the difficulty of selecting a route was encountered. No less than eleven different passes were surveyed from the Peace river in the north to the Crow's-nest pass in the south. The railway was opened in 1886, and as a result access to the Rocky mountains was at last made easy for the ordinary traveller. But as a matter of fact very little advantage was taken of the opportunities offered, at least as far as exploration of the main chain of the Rocky mountains was concerned.

Dr. George M. Dawson, head of the Canadian Survey, was the first to utilize the facilities offered, and published a very full "Report on the physical and geological features of that portion of the Rocky mountains between latitudes 49° and 51° 30″ (1886)." In 1886 Mr. R. G. M'Connell made a detailed examination of the Bow river pass and the vicinity. In 1898 Mr. McEvoy surveyed the Athabasca river valley for about 150 miles east of the Yellowhead pass, and down the Fraser river on the west side of the pass for another 80 miles.

In 1892 Prof. Coleman explored the country from Morley, on the Canadian Pacific Railway, to the head of the Athabasca river, and was the first to authoritatively show that Mounts Brown and Hooker, on the Athabasca pass were not 16,000 feet high, but merely the same altitude as all the neighbouring peaks.

Nearly all our knowledge, therefore, of the Rocky mountains up to

about 1897 had been obtained in the early part of last century from the fur-traders, and later by those looking for passes over the main range. The exploration, therefore, was restricted to the chief river valleys and the low passes; the great snowfields, the high peaks, and the glaciers that form the backbone of the continent remained to be discovered. The large area of unknown country in Canada at the present day is hardly appreciated. Dr. Dawson wrote only twenty years ago, "In Canada there are 3,470,000 square miles, of which 954,000 square miles (exclusive of the inhospitable Arctic portions) is for all practicable purposes entirely unknown."

It was in the year 1897 that I first went to the Rocky mountains. Starting from Laggan, on the Canadian Pacific Railway, I went north with Mr. Baker as far as the source of the Saskatchewan river. The country was almost unknown; the only man who had been there and left any record was Hector, in 1860. Far in the north we saw an endless series of high snow mountains. In 1898 I returned with H. E. M. Stutfield and H. Woolley. We went north to the sources of the Athabasca, and discovered a great snowfield, the source of the north fork of the Saskatchewan and the Athabasca rivers, and probably at one time the source of the Columbia river as well. This great snowfield, therefore, drains into three oceans, the Pacific, the Arctic, and the Hudson bay (or the Atlantic). As a result of this expedition and two more I made in 1900 and 1902, to the same district, I was able to make a sketch-map that the Royal Geographical Society published in 1903.

I should not have been able to explore this country if it had not been for the Canadian Pacific Railway that brought me to the door of the mountains. It was obvious, therefore, that as soon as a railway was built westwards from Edmonton to the mountains and the Yellowhead pass, I could use it for approaching the main chain of the Rocky mountains north of the Yellowhead pass, and explore them in the same way as I had done north of the Kicking Horse pass.

In 1910 the first section of the Grand Trunk Pacific Railway was open almost up to the foothills. Making use of this, Mr. A. L. Mumm and myself started on July 17 from Wolf creek with pack-horses and an outfit to last us for two months. With us came Moritz Inderbinen (a Swiss guide) and Fred Stephens, G. Swain, John Yates, and Allan McConnochie, the last four to look after the horses, cut trail, and manage the camp.

Our route lay along the valley of the Athabasca till we came to the Miette river; this we ascended to the Yellowhead pass. This pass like many others in the Rocky mountains, drains both ways, the headwaters of the Miette sometimes going westward; the usual direction, however, is eastward to the Athabasca. Following down a tributary of the Fraser river, we came on August 1 to Moose lake. We then struck northwards up the Moose valley, by a route discovered by John Yates two years before

when with Prof. Coleman. At the head of the Moose river is a pass leading over on to the watershed of a tributary of the Peace river, named the Smoky river. An account of Prof. Coleman's journey over this pass and a small map were published by the Royal Geographical Society.* All existing maps, with the exception of Prof. Coleman's, are entirely wrong about this part of Canada. The watershed of the main chain is put far to the east of where it should be, making it necessary to show all the streams that run westward to the Fraser river many miles longer than they really are. The source of the Smoky river, too, is marked about 80 miles north of its true position, namely, in the glacier of Mount Robson. We reached the base of Robson on August 9.

Our primary object was, if possible, to climb Mount Robson, 13,700 feet, at present the highest known mountain in the Canadian Rocky mountains. The weather, however, was far too unsettled for any attempts to be made on it. Whilst we were waiting for the snow to clear off the big peak others were climbed. One, a snow mountain, the third highest probably in the group, that lay some miles north of Mount Robson, 11,300 feet, gave us a good view into the unknown country to the north. On August 22, after three days of bad weather, a heavy snowstorn enveloped the whole countryside in about a foot of snow, entirely destroying all our hopes of climbing Mount Robson. We therefore determined to strike north down the Smoky river and ascend such side valleys as would be likely to lead us easily to the watershed. Our first attempt was not successful owing to the dense forest; we were driven back again to the Smoky river. Further north we were more successful. Following a large stream that came from the west, we discovered a splendid snow mountain that Yates named Mount Bess, also a large glacier on the east side of the mountain. Another fact which was rather a surprise to us was that right under the almost perpendicular limestone precipices of Mount Bess on the south side, was an easy pass over the watershed into British Columbia. It is below tree-line and covered with pine forest. By this time it was necessary to think of returning to civilization, and the question arose, should we return by the route by which we had come into the mountains, or should we risk trying to work eastwards and hit the Athabasca at either Jasper House or even lower down at Brulé lake? If we chose the latter route it would mean finding some pass out of the valley of the Smoky river on the east, so as to get on to the headwaters of a river called the Stoney.† Yates had heard from some Indians that such a pass existed, but where it was we did not know. What we did know was that should we miss the Stoney river we should probably

* *Geographical Journal*, vol. 36, No. I. (1910), p. 59.

† In all the old maps it is called the Snake Indian river. Hector, 'Palliser's Journals' (1863), p. 125, says it is known "either as the Assiniboine or Snake Indian river;" on p. 126 he says, "a trail through this valley leads to the Smoking river, a branch of the Peace river, but it is said to be very rugged."

LOOKING ACROSS THE GREAT GLACIER.

HIGH SNOW MOUNTAIN FROM MOUNT HOODOO.

FALLS OF THE MOOSE RIVER.

STONEY FALLS.

HIGH SNOW MOUNTAIN (11,500 FEET), FROM MOUNT BESS.

FALLS ON THE GRAND FORK OF THE FRASER RIVER.

be on the Sulphur river that ran northwards; also, should we follow the Sulphur river, ultimately it would bring us back again to the Smoky river far north of where we were, and hundreds of miles from Edmonton.

We decided, however, to try, and on September 2 we started down the Smoky river intending to turn east up the first promising-looking valley, in the hopes that we should find a pass at its head over which we could take the horses. In the valley up which we decided to go we found a beautiful lake with two small islands in it, each only a few square yards in area, and on each of them a pine tree growing. Yates, who is the best guide in an unknown country I have ever met, by some instinct refused to follow the valley to its head, and turned up a side valley; two days later he proved to be right, and we crossed an easy pass above tree-line, over miles of rolling grass uplands and descended on the other side to an unknown stream that certainly was flowing in the right direction for the Athabasca river. But we were not yet by any means certain that we were on the Stoney river; if it made a bend round to the north-east it might be the Sulphur river, and should it continue due south it might be the headwaters of the Snaring river that drains into the Athabasca between the Stoney and the Miette rivers. If it was the Snaring river, we knew that it was impossible to get horses down the last 20 miles owing to canyons and heavy timber. Our river, however, did not flow south, but some distance down turned to the north-east, and for the next three days we were quite uncertain whether after all we had not hit the Sulphur river by mistake. Ultimately it proved that we were right, and Yates had successfully guided us out through about 100 miles of new country and discovered a very useful and good trail from the Athabasca to the headwaters of the Smoky river. We reached the Athabasca river at the foot of Brulé lake on September 16.

Next summer Mumm and I decided to utilize our new route to the country at the headwaters of the Smoky river, but instead of crossing the Athabasca at the foot of Brulé lake, where we had emerged from the mountains in September, 1910, we decided to cross higher up at Jasper House at the mouth of the Stoney river, and ascend that river some 25 miles to where we could join our trail of the year before. We had not come down this last 25 miles in 1910 because of the immense amount of burnt timber, which would have taken us days to cut through, and because we knew that by leaving the Stoney river and hitting the headwaters of the Hay river we could easily get to the Athabasca at Brulé lake.

The party was the same as the year before, except that G. Swain did not come.

On July 24 we started up the Stoney river from the Athabasca. With us came also J. Smith, who had prospected up the Stoney river for coal and knew the country; he also, being a good axeman, could help us greatly in cutting a trail through the miles of fallen and burnt timber. It took us seven days to accomplish the 25 miles, and on July 31 Smith left us to

return to civilization. On our way up we passed some very fine falls of the Stoney river; these Hector mentions in 'Palliser's Journal.' *

At one of our camps, on August 2, we found an old inscription on a pine trunk: "Jack Grame (or Grainer?) and Archie Turnbull, May 20, 1895 (?1875)." Probably these were trappers who had penetrated thus far into the wilds. We reached the summit of the pass leading over to the Smoky river on August 4; here we camped for three days, partly in order to give the horses a rest, and partly to enable me to climb a peak so that the points on my plane-table survey could be connected up with as many distant high peaks as possible. Up to that time we had been travelling along the bottom of deep valleys, and only the peaks on each side of the valleys could be seen. On August 7 we ascended a rock peak on the east side of the pass. This peak we have named Mount Hoodoo, in honour of a bulldog of that name who, much against his will, was taken to the top of the mountain. We had no choice in the matter, for, missing his master Yates in the camp, he followed our footsteps and joined us just below the last part of the climb. The last 600 feet of the peak was bare rock, set at a very steep angle; if we had gone on he would have tried to follow Yates, who was with us, and would inevitably have fallen over the precipice. So we had to carefully tie him on to the end of the rope, and he was pulled up bodily most of the way.

The day was brilliantly fine, and the view we had from the summit stretched for miles in every direction. I was rather surprised to find that we were nearly due north of Mount Robson, and were therefore further west than I had expected. Mount Bess that we had discovered the year before proved to be only one peak, and the most southerly, of a group of high snow mountains, one a little to the north being evidently higher. Glaciers could be seen in more places than one descending to the creeks that led down to the great valley of the Smoky river.

Next day we broke up our camp and started for the Smoky valley, with the intention of ascending one of the creeks that came down from the foot of this new high peak. We arrived at the head of the creek on August 11, and camped at the foot of a magnificent glacier that descended into the valley in a series of beautiful ice-falls. This glacier is the biggest one I have seen in the Canadian Rocky mountains; perhaps it is not as large as the one that flows out of the Columbia icefield into the head of the Bush river valley, but this latter glacier I have only seen in the far distance. At this camp we stopped for ten days, and explored the country round about.

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* 'Palliser's Journals,' p. 126: "Ten to twelve miles up the river there are some splendid waterfalls, and beyond that point the valley is at a very high level, and the woods that occupy (?) are favourite haunts of large bands of cariboo, or mountain reindeer. Smoking river is about two (?) days' journey to the north-west, and along its valley there are extensive prairies, of which the Irroquois hunters speak in high terms as the finest land in the country."

The glacier itself is most interesting and appears to be advancing very considerably; in fact, most of the large glaciers that I have visited in the Rocky mountains during the last fourteen years seem to be advancing. The snout of the glacier is about 200 feet high, and comes down on to a shingle flat; there are a few moraine heaps just in front of it that have quite recently been formed. The markings along the hillsides on both flanks of the glacier also point to the fact that it never has been much higher than at present. Moreover, about 2 miles up the glacier on its north bank is a small valley cut off on all sides by rocks, snow, and ice from the surrounding country; this valley is filled with pine forest. Across its mouth flows the great glacier, the level of the ice being nearly 200 feet above the floor of the valley, and the stream that comes down the valley disappears into a cave underneath the ice. Should this outlet to the stream become blocked, obviously a lake would form. That such has been the case seems probable, for below the snout of the glacier and on the north side of the shingle flat, a pine forest has been swept by a big flood within the last couple of years. Beneath the trees are nothing but bare stones and boulders, whilst in many places the whole of the bark has been battered off the trunks of the pines for 2 or 3 feet by stones being hurled against them by the water.

Another piece of evidence that seems to point to the glacier having increased very greatly in recent years is the fact that about 2 miles up the glacier and at least a mile from the nearest vegetation, there is a small island of rock, about 200 yards long, on which pine trees are still growing, whilst the level of the glacier is in many places higher than the island.

Several expeditions were made up the glacier. Mumm went to a pass at the head of a side glacier that comes into the main glacier on the south side. About 2 miles from the bottom of the main glacier is the first ice-fall, and about a mile further up is the second and larger of the two. The first can be easily turned on the north side of the glacier, but the second is more difficult; in fact, we only found one place where it was at all easy, and that place was distinctly dangerous, for it might be swept by avalanches at any moment. The route lay also on the north side of the glacier, just between the ice and the sheer rock precipice that abuts on to the ice.

On August 18 we started before sunrise, and ascended above the second ice-fall, finally finding ourselves on a great plateau of snow that stretched for miles away to the north and west. Surrounding this snowfield was a series of rock and snow-peaks. Crossing this plateau to the west, we made our way to a snow col between two peaks; then, following the arête on the northern side of the col, we reached the top of one of the highest mountains of the group. The day was wonderfully clear, and we could see into the far distance in every direction. To the north, beyond the snowfield and the mountains surrounding it, the range of the Rocky mountains became much smaller in height, and it was not until about

20 miles further north that the range again began to show really big mountains and large glaciers. To the east lay the great valley of the Smoky river, running northwards almost as far as we could see. To the south, quite close, was the biggest peak of the group we were in. A little further south rose Mount Bess, dome-shaped, and flanked by precipices, apparently just the same height as the peak we were on; whilst further away in the distance rose Mount Robson, a head and shoulders taller than all the surrounding peaks; also the Horn, and the snow-peak we had climbed in 1910.

It was, however, the view to the west and south-west that was by far the most interesting. At our feet lay unknown valleys that led down to the Fraser river; between us and the great Fraser valley that runs parallel with the main chain of the Rocky mountains, was another range of mountains, not so high as the main range, but the highest points on it were not 1000 feet lower. Far away in the distance beyond Fraser valley and Tête Jaune Cache rise the great range of the Cariboo mountains. We could see several high peaks, great snowfields, and more than one great glacier. This mountain land in the near future should prove a great field for mountain exploration. At the present time it is practically impossible to get at; even the hardy prospector has never penetrated into its fastnesses. The dense western forests with their fallen trees, thick underbush full of devil's club, and the turbulent glacier streams, have stopped even the most venturesome. Possibly when the Grand Trunk Pacific Railway has opened up the Fraser valley, it will be possible to send in men with saws to cut through the immense fallen logs and with axes to clear a trail, but it will need both time and money to do it. It will, though, be well worth accomplishing, for the Cariboo mountains, in my opinion, are a finer range than the Selkirks, they are probably higher, and certainly the peaks are very beautifully shaped mountains. This is to be expected, as they are formed of a very old rock, namely, the archean.

On August 22 we started down the valley with the intention of working north along the Smoky valley, and if possible ascending the next large creek that would drain the country on the north of the group of mountains we had been in.

But we soon found that the time at our disposal was not sufficient, for the travelling was bad, and from a point we ascended by the side of the Smoky river we could see nothing but burnt timber ahead of us, and country that looked as if the muskegs would give us endless trouble. We could see down the Smoky valley for 15 to 20 miles, and the whole way it was running a little east of north.

So we retraced our steps in order to accomplish what we knew we could do in the time, namely, visit the pass we had been on the year before under Mount Bess, and explore a fascinating piece of country that lay on the west side of the pass in British Columbia which we had seen from the summit of the mountain we had climbed.

MOUNT ROBSON FROM THE NORTH-EAST.

LAKE ROBSON PASS.

THE UPPER ICE-FALL OF THE GREAT GLACIER.

LOOKING NORTH DOWN THE SMOKY RIVER.

On August 24 we reached the pass, and on the 26th in most brilliant weather we ascended Mount Bess. On the summit there was not a breath of wind, and the atmosphere was magnificently clear. We could see mountains for 100 miles in every direction, and, for the first time, I saw through a break in the hills to the east the level pine woods stretching away to the prairie. The Cariboo mountains were as usual splendid, two peaks being especially fine. Far away to the south was a grand mountain somewhere in the Selwyn range. Robson and his satellites seemed quite near. Mount Geikie towered up, showing his grim precipices plainly through the clear air; and far away in the dim distance at the head of the Athabasca was a shapely snow pyramid that was almost certainly Mount Columbia. Never have I been on the summit of any peak in more favourable conditions, and as we gazed in every direction over peaks, glaciers, snowfields, and valleys, we recognized how much remained still to be done in this new land; as far as I was aware, out of the innumerable peaks that we could see spread out before us only two, Mount Columbia and Mount Robson, had ever been climbed by any one except by ourselves.

We next moved our camp to the west side of Mount Bess, following an old Indian trail that came from the Smoky river over our pass. This trail at one time must have been an important one, for in many places it was deep cut into the moss and earth in the pine woods. But when we first found it in 1910 it had not been traversed by horses for years, and the old teepee poles left at an Indian camp on the summit of the pass were embedded in the ground and perfectly rotten. Probably it was more than thirty years since any one had been there. But the mystery was where did the trail lead? After crossing the pass it did not descend the valley on the west side, but led high up the hillside on the right, finally crossing a spur of Mount Bess, and going down to a mysterious valley that ran north skirting the whole of the large group of mountains north of Mount Bess. The valley then turned slightly to the east, and neither from the summit of the first snow-peak we ascended nor from the summit of Mount Bess could I discover where it broke through the range that divided it from the Fraser river. It is most probable that it is the headwaters of the Beaver river that flows into the Fraser some distance below Tête Jaune Cache, but at the same time it might be a tributary of the Smoky, thus putting the watershed further west than the main chain of the mountains. This is not so impossible as it seems, for the watershed of the Rocky mountains plays strange tricks. There are many instances that I know of where the water runs both ways; the Miette is one that I have already referred to. The waters that issue from the great glacier of Mount Robson are perhaps the most interesting case. In 1909, when Mr. Mumm visited Mount Robson, they almost entirely flowed into the Smoky river; in 1910, when he returned, they had cut a new channel in the shingle flat, and were flowing west in the Grand Fork of the Fraser river. In 1909, therefore, the whole glacier was on the eastern watershed, and presumably belonged to

Alberta, whilst in 1910 it was on the western watershed and had entered the state of British Columbia. There is also a glacier that descends on the north side of the snow mountain we ascended in 1910; at its foot is another shingle flat, and as far as I could see some streams wandered over it to the east and so to the Smoky river, others went in the opposite direction down Horse creek to the Fraser river.

To the west of Mount Bess and separating Horse creek from the mysterious valley lay a most curious piece of country, lying at about 7000 to 8000 feet, and therefore above tree-line. Instead of being a range of peaks as would be the case everywhere else in the main chain of the Rockies, it was a rolling moor covered with grass. Over this one could walk with ease. It is a most beautiful spot surrounded by the great snow-peaks and with deep pine-clad valleys on both sides, and occasional glimpses through gaps in the mountains of the far distant glaciers.

The scenery of the Rocky Mountains has a charm all its own; one is not dependent on the mountains for the chief effects; it is the under-world of forests, lakes, rivers, and far-reaching valleys that gives the chief note to the scenery of these far distant western wilds. It is true that there are mighty mountains, great glaciers, and pinnacles of rock, that make magnificent views, but so there are in many great ranges, and the Canadian Rocky Mountains cannot compete with parts of the Alps, for instance, Mont Blanc, or with any of the greater ranges such as the Caucasus or the Himalayas. All the highest peaks in the Canadian Rockies are limestone, and limestone is not a rock that ever weathers into the finest forms. It is in the valley scenery that this western country is second to none. The silent forests through which one has to go sometimes for days together, whilst all around lies piled the ruin of ancient woods side by side with the marvellous new growth, the tangled wreck of a lifetime, the luxuriant growth of centuries. On the passes are often long stretches of meadows, with clumps of pines here and there and masses of small rhododendron bushes. Masses of flowers can be seen in every direction, daisies, anemones, and lupins that swing in the breezes. Wandering down to the valleys are clear streams, often with trout in them; and then there are the lakes! nowhere have I seen such beautiful lakes as one finds hidden away amongst these mountains. Lake Louise, Lake O'Hara, are known to the world, but there are many others that I have seen far away from the haunts of men, lakes of turquoise, lakes of beryl, and lakes of the deep indigo of the open ocean, that reflect the long shadows and the images of the silent peaks, the dark pines, and the golden sunsets in the summer evenings. I remember one evening, long ago, in the Bush valley. We had camped by the solitary Bush river. In the foreground water and shingle stretched in desolate fashion westward to where the Bush river joined the Columbia river, and where ridges of dark pine-trees cut the middle distance. Far away rose the peaks of the Selkirks silhouetted against a glorious sunset, a mysterious land unexplored and unknown. The gnarled

trunks of the pines, festooned with moss, were lit up by the last rays of the sun and the mysterious forest darkened by contrast. A faint evening breeze sighed through the upper branches of the pines; we were alone in a new land, and it was a good land. The Canadian Rockies can give much to those who love the sunshine, the fresh air, and a country as yet unspoilt by man.

But it was high time for us to go, we had put off the evil day when we had to start on the home trail to the very last moment, and had calculated to a day how long it should take us. We should have to travel rain or shine, and we therefore hoped for fine weather, for a dripping pine forest is good neither for men nor baggage, and to camp in the evening wet through in a swamp is to say the least dismal. Fortunately, we were treated very much better than in 1910, when we made our way from the Smoky river and down the Stoney river through a series of snow-storms. From the day we left Mount Bess till we went on board the cars of the Grand Trunk Pacific Railway not a drop of rain fell. The summer of 1911 in the mountains was certainly a very open one; it was the only summer out of six that I have spent in the Rocky mountains when we did not have snow down in the valleys, and I have never seen the foothills so free of snow.

On September 15, we crossed the Athabasca at Prairie creek, and were once more in touch with civilization and a railway. No longer should we sit over the camp fires in our tent and listen to the stories of Fred Stephens about bear hunts, prospectors, hunters, and the endless other subjects that are of interest to the dwellers in the wilds. No longer should we laugh over the small jokes and the small happenings that go to make up life in camp; we were soon to be engulfed by the great whirlpool of everyday life where the dollar counts for more than the man, and where the chains of custom bind one to the conventional life of civilized society. Those who have never tasted the freedom of camp life amongst the great mountains can hardly understand the immense peacefulness that it all means. One does not trouble much either about the yesterdays or the to-morrows, and the hours do not fall heavily. Yes, the camp life is healthy for both mind and body, and the wanderer amongst the great mountains can sleep peacefully and dream of the snows and mighty woods, of the rushing rivers, and the clear lakes reflecting the white clouds, and the rock peaks, and can feel with far more certainty than most that "all's well with the world."

Major LEONARD DARWIN (Chairman, before the paper): I regret to have to say that our President, Lord Curzon, is laid up with a cold in the country, and much regrets he is unable to attend here to-day.

Major DARWIN (after the paper): Many who have listened to this extremely interesting paper, especially those who did not hear Prof. Collie's last lecture, must have felt a certain surprise at learning what vast areas there are of unknown land in Canada. We most of us picture Canada as a land of rolling prairies, rapidly

being brought under the plough, where the emigrant is moving in all directions; but now we learn that there are miles and miles of utterly unsurveyed districts, which have never been traversed by man, and certainly never mapped before. I think the Government of Canada is probably wise, as regards surveying, to devote their first efforts to those regions which are likely to be most productive; but surely before long they ought to turn their attention in their own interests to those vast mountain regions. It is perfectly true, as Dr. Collie has told us, that they are composed mainly of limestone, and are therefore not likely to contain great mineral wealth. What, then, is the future of that district? Why, it will be the playground of all America; and if we look to Switzerland we can see how valuable is the possession of such a playground if developed. It will only be when systematic surveys are undertaken that the full value of this pioneer work will be appreciated. Dr. Collie has shown us by his remarks that he appreciates the work that was done by his predecessors in that field, and I am very glad that he should have mentioned their names here to-night, because amongst those names there are many that are not sufficiently well known. I should like to mention one name particularly, that of Sir Alexander Mackenzie, a name far too little known amongst geographers. He was the first white man who ever crossed from the Atlantic to the Pacific in North America, and that was one of the greatest of geographical feats. Yet his name is altogether unknown—almost forgotten—by us. As to the reason for this, he possessed qualities which, to say the least, are not common amongst explorers. He was excessively reticent and he was excessively modest, and his fame has suffered from his having done the reverse of exaggerating his own feats. Prof. Norman Collie knows what good work those pioneers did, how their work helped him. The work of Prof. Norman Collie will not be sufficiently appreciated for many years to come, but in time it will be appreciated in the same way that he has appreciated the work of his predecessors. Prof. Collie was accompanied by his faithful friend Mr. Mumm, who shares with him the honour of this work, and I hope he will say a few words to us on this occasion.

Mr. A. L. Mumm: A few months ago, when Dr. Longstaff was reading a paper on the Spillimacheen section of the Selkirk range, I made some random and unconsidered remarks about Canadian scenery; amongst others, one to the effect that the Canadian mountains were very deficient in the matter of waterfalls. I gladly seize this opportunity of qualifying that remark; I really had in my mind the kind of waterfall which leaps from above into a valley in the manner of the Staubbach. But there are waterfalls of another kind which are formed by the main river at the bottom of the valley; a familiar instance in Switzerland is the Falls of the Aar at Handeck; in the Alps they are not so frequent, but that is the kind of waterfall in which Canadian scenery is, in fact, very rich, and of which you have seen some very beautiful examples this evening. But it is quite true that they are not exactly conspicuous features of Canadian landscape. That fall in the Moose valley which Dr. Collie showed at the beginning of his lecture, I passed twice within a few hundred yards without seeing it. It was only on my third journey that I found my way to it; so too the falls in the Stoney river are quite close to the trail, but if one did not know they were there, one might easily pass without seeing them, and only be aware that there was something there by the roar of the water. Well, one might ask, If you heard the roar of the water, why not stop and go and look for the waterfall? There are two reasons—one is that when you are travelling with a pack-train, it is extremely difficult to stop; and the explanation of that is to be sought in the temperament of the cayoose, or Indian pony. The other reason is, that though you may have heard the waterfall roaring 200 or 300 yards away, and may think that probably you will be able to get to it in ten

minutes, it is always possible that it will take an hour or two hours, or that you may not be able to get there at all. I dwell upon those two things because, quite apart from waterfalls, they are the two most characteristic features of Canadian travel. Canadian travel has a very distinct individuality of its own, and the causes of that are, firstly, what you may call the psychological make-up of the cayoose; and secondly, the almost diabolical ingenuity and resource of nature in planting all sorts of unforeseen obstacles to human progress. That particular region we passed through is in a very interesting state just now; it has only been recently begun to be made accessible. I suppose that next year or the year after the railway will be running from Edmonton to Prince Rupert, and there will very likely be half a dozen hotels between Prairie Creek and Tête Jaune Cache. But that is only a line down the middle, and there is an immense hinterland on both sides waiting to be explored. It will provide work for a generation of explorers, and it will be endlessly long before that country is exhausted in a mountaineering sense. I should like to add one word of cordial endorsement to Dr. Collie's reference to the merits of John Yates as the path-finder. He is one of those born pioneers with whom it is a pleasure to travel, and I hope to make yet another trip with him into the tributaries of our old friend, the Smoky river.

THE YALE PERUVIAN EXPEDITION; PRELIMINARY REPORT.

By Prof. HIRAM BINGHAM, Director.

THE Peruvian Expedition, as approved by the Yale Corporation, consisted of seven men: Prof. Hiram Bingham, director; Prof. Isaiah Bowman, geologist-geographer; Prof. H. W. Foote, collector-naturalist; Dr. Wm. G. Erving, surgeon; Mr. Kai Hendriksen, topographer; Mr. H. L. Tucker, archæological engineer; and Mr. P. B. Lanius, assistant.

We landed at Mollendo, the chief seaport of Southern Peru, in June, 1911, and went at once to Cuzco, the old Inca capital.

The first field of operations was the Urubamba river and its affluents, including the hitherto unknown Rio Pampaconas. The second was a cross-section from the head of canoe navigation on the Urubamba south over the Andes to the Pacific ocean. The third was the neighbourhood of Mount Coropuna and Lake Parinacochas. For this last, Arequipa was used as a base. The field work occupied five months. The expedition was divided into three parties to do archæological, geological, and topographical exploration.

The Peruvian Government, acting on the initiative of President Leguia, gave the expedition free entry for all their supplies, and loaned the services of several soldiers and non-commissioned officers. Through the courtesy of President Taft, the United States Coast and Geodetic Survey loaned the necessary topographical instruments, and the Army a complete medical equipment, including typhoid vaccine.

The topographical work was in charge of Mr. Kai Hendriksen, formerly of the University of Copenhagen, and later of the United States Coast and Geodetic Survey on the Canadian boundary. Mr. Hendriksen

reports that he made seventeen topographical maps, took fifteen observations for latitude and twenty-seven observations for longitude, and made several plans of ruins. His report is as follows :—

"One detailed topographical map, scale 1 : 45,000 ; 100-feet contours ; 50 square miles ; showing characteristic physiography of Central Andes, west of Cuzco. *Astronomical basis :* one observation for latitude, two observations for azimuth and longitude.

"One detailed topographical map, scale 1 inch = 300 feet ; 20-feet (and in places 5-feet) contours ; $1\frac{1}{2}$ miles long ; $\frac{1}{2}$ mile wide ; of a quebrada near Cuzco, where interesting bone and ash deposits were found. The map shows bench-marks, to which photos and discoveries were tied.

"One detailed topographical map, scale 1 : 9000 ; 20-feet contours ; 2 miles long, 1 mile wide ; of Cuzco and vicinity. Shows the above-mentioned quebrada and famous ruins near Cuzco.

"One topographical map (standard *) *c.* 30 miles long, 5–10 miles wide, over the Urubamba valley from Piscocucho to Mandor Pampa. The map shows the position of most of the ruins found in the Urubamba valley. Jungle in the greater part of the valley. *Astronomical basis :* one observation for latitude, two observations for azimuth and longitude.

"One topographical map (standard) *c.* 30 miles long, *c.* 5 miles wide, over the Vilcabamba valley from Chaullai to Vilcabamba. Jungle in the lower part of the valley. *Astronomical basis :* one observation for latitude, two observations for azimuth and longitude.

"One route-survey, with astronomical positions, *c.* 60 miles long, showing form-lines of about 200 feet differences in elevation. The survey and return was made in ten days on foot from Vilcabamba to Esperitu-pampa, where Inca ruins were found. The trail followed was very narrow through heavy jungle. Much rain. No accurate survey could be made. Directions by prismatic compass, distances by time and pedometer, elevations by aneroid. *Astronomical control :* five observations for latitude, eleven observations for azimuth and longitude.

"Quick route-survey from Vilcabamba to Abancay (by Prof. I. Bowman). *Astronomical basis :* two observations for latitude.

"Ten topographical maps (standard), 250 miles long, 5–20 miles wide, 40 days. Cross-section over the Andes from Abancay to the Pacific coast (Camana). The map of Coropuna is a part of this map. *Astronomical control :* five observations for latitude, ten observations for azimuth and longitude.

"One detailed topographical map, scale 1 : 45,000, 100-feet contours, 30 square miles of pass between Lambrama and Chuquibambilla. Showing characteristic glacial topography.

"Three plans on ruins of large scale of the ruins of Aquente and Torontoy. Measured by tape and stadia, with accurate measurements of each building. Several accurate measurements of smaller ruins.

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* The standard maps of the expedition are : scale 1 : 9000, 200-feet contours.

"All the standard topographical maps are done by exact methods of survey. Distances by micrometer screw combined with triangulation. Elevation by vertical angle. The distances are determined with an accuracy of 50–100 feet. Elevations with an accuracy of *c.* 30 feet. The more detailed topographical maps are made by same method. The two detailed topographical maps on very large scale, near Cuzco, are made by stadia and vertical angles."

A bathymetrical and topographical survey was made of Lake Parinacochas, 11,500 feet above the sea. A folding boat was successfully carried from this country. According to the story given us by the natives, Parinacochas was navigated for the first time. We found its length to be about 17 miles and its width 6 miles. The greatest depth is not over 6 feet. At the time of our visit, in the dry season, it had somewhat shrunk, so that we failed to find any depth over 4 feet 6 inches. A sample of the water was brought home to be analyzed. On the shores of the lake were found many primitive ruins, indicating the former presence of a large population.

Mount Coropuna was successfully climbed by the Director and Mr. H. L. Tucker, and later was triangulated by Mr. Hendriksen. A comparison between the mercurial barometer taken to the top and one read simultaneously in Arequipa 100 miles away, gave an altitude of 21,640 feet. Mr. Hendriksen's careful survey and triangulation of the mountain from its vicinity to the sea-coast raised this estimate to 21,703, with a mean error of 35 feet. The altitude given to Coropuna on the map of Peru by the Royal Geographical Society, 22,799 feet, is thus seen to be more than 1000 feet too high; and Coropuna, instead of being the highest mountain in America, probably only occupies fourth or fifth place.

The geological and geographical work was in charge of Prof. Isaiah Bowman, who makes the following report of his results:—

"(1) Geological map across the Andine Cordillera from the mouth of the Timpia southward along the 73rd meridian to Camaná on the coast.

"(2) Physiographical interpretation of the belt of country traversed.

"(3) Meteorological observations along the line of traverse, including notes on wind, clouds, temperature, humidity, etc., and a set of about fifteen daily temperature curves for typical stations.

"(4) Notes on the anthropogeography of the natural regions which were crossed, including the relation of the people to the physiography and geology; also trade routes and movements, products, systems of land tenure, rotations of crops on artificial terraces, the rubber industry, and other data of economic geography.

"(5) In further explanation of (1) and (2)—

"(*a*) Collection of fossils (Devonian, Carboniferous, Cretaceous, and Tertiary, chiefly) from six type localities. (*b*) Interpretation of the structure section across the Cordillera. (*c*) Interpretation of the geology

of the Cuzco basin, including the finding of Tertiary fossils and the origin of the famous 'Rodadero,' wrongly supposed for many years to have been glaciated. (*d*) Determination of the level of perpetual snow, and the limits of past glaciation—of special importance in connection with the problem of decreasing level of snow-line towards the equator. (*e*) Glacial forms and their interpretation: a study of the effects of glacial erosion in valleys from which the ice of glacial times has been withdrawn. The results of these studies bear out in a striking way the conclusion that ice is a powerful agent of denudation. Special attention was given to the glacial alluvium about Cuzco in order to determine the importance of human remains found therein. (*f*) Clear geological and physiographical evidence of past climatic changes beyond the limits of glaciation, especially in the deep valleys of the Cordillera and in the desert of the coast region. (*g*) Evidences that the great coastal terraces have had a complex history, including a submergence in the Tertiary and a later stripping still in progress. (*h*) Discovery that the great Tertiary cycle of erosion, ending in the formation of well-graded mature slopes, affected this region as well as the region further south studied in the Yale South American Expedition of 1907. (*i*) A study of the relation of the forests of the region to water-supply, slope exposure, and soils. (*j*) A set of observations on the temperature of water and air along the Peruvian coast in relation to (i.) the counter current sometimes visible; and (ii.) to the more abundant showers on the coast hills, a feature especially important during the past season. (*k*) Topographical sketch-map of the Urubamba valley between Rosalina and Pongo de Mainique, indicating the form of the land by contours, and showing the positions of the large number of whirlpools and rapids. (*l*) Route-map across the Cordillera Vilcabamba, indicating geological boundaries and the positions and relations of the principal glacial forms. (*m*) Pleistocene history of the Lake Titicaca basin."

The natural history collections were in charge of Prof. H. W. Foote, who makes the following report:—

"On the advice of the Yale biological department, collecting was limited mainly to insects and non-flowering plants, including mosses and liver-worts. This was done partly because it was impossible for one man to collect effectively in many different lines, and partly because the birds, animals, and flowering plants of Peru are fairly well known, while the orders which were collected were not. Collecting was chiefly carried on along the valleys of the Urubamba, Vilcabamba, and Pampaconas rivers, a distance of perhaps 250 miles, from an altitude of over 12,000 feet (at Vilcabamba) to 3000 feet (Santa Ana). A fair collection was also made about Cuzco. It was the dry season and winter, when insects are not so plentiful as in the wet season when it is warmer. Nevertheless, approximately 3000 specimens of plants and insects were obtained, besides several hundred land shells. Little or no collecting has been

done before in the districts visited, and it is believed that the collection will add materially to our knowledge of geographical distribution. It is also probable that some new species have been obtained. Arrangements have been nearly completed to have the collections investigated by specialists, who will publish their reports later. Ultimately, it is hoped to deposit most of the collection in Peabody Museum."

A few archæological discoveries were made by the director. Among them are the ruins of a number of Inca or pre-Inca cities, including—(1) Macchu Pichu, a city probably built by the "megalithic race" who preceded the Incas. The ruins are on an almost inaccessible ridge, 2000 feet above the Urubamba river. They are of great beauty and magnificence, and include palaces, baths, temples, and about 150 houses. Carefully cut blocks of white granite, some of them 12 feet long, were used in the construction of the walls. The city was surveyed by Messrs. Tucker and Lanius. (2) The temple of Yuracrumiu, the centre of the Inca religious cult after the fall of Cuzco, containing a carved monolith 185 feet in circumference. (3) Vitcos, the palace and capital of Manco Capac, the last Inca, probably built after his retreat from before Pizarro's conquering army. (4) Vilcapampa, a purely Inca town now completely buried in the dense jungle of the Rio Pampaconas, but containing characteristic Inca pottery and bronze implements. (5) A number of other primitive towns in the coastal desert provinces, two of which were marked by volcanic boulders covered with pictographs, including drawings of jaguars, llamas, and dancing men.

Near Cuzco a wall was discovered probably over 100 feet long, partially exposed by recent erosion. Excavation revealed the fact that it was buried beneath 6 feet of gravel, deposited on both sides and on top of it by the action of water. The wall was about 4 feet in thickness, faced with carefully cut polygonal stones on both sides, the middle being filled in with rubble. As the wall resembles some of the oldest and best-known walls in Cuzco, and here was found to be covered by compact gravels, the age of this type of wall will depend largely on the geological evidence regarding the gravel. If this gravel should prove to have been deposited in glacial times, it would revise the prevailing notions. The natives generally consider it to be Inca; some scholars regard it as pre-Inca. The geological evidence appears to be decidedly in favour of the latter view.

Human bones were found in the same valley, embedded under 75 feet of gravel, interstratified with the gravel beds and with the bones of several lower animals. They were excavated by the Director and Prof. Bowman in the presence of Prof. Foote, who photographed the bones in position.

Prof. Bowman made a detailed study of the geology of the surrounding region, and makes the following preliminary report:—

"The geographical and geological study of the bones found near Cuzco

indicated that they were contemporaneous with the compact gravels in which they were embedded. They were disposed in the form of a lense about 10 feet long and 6 inches thick. From (1) their disposition with respect to each other (they were jumbled and essentially flat), (2) their relations with the bedding planes (some of which passed directly through the bone deposit), and (3) their worn condition (the finer details are absent), it is concluded that they were interstratified with the gravel beds. The age of the beds thus becomes the determining fact in the interpretation."

From a detailed study of the geology of the upper Cuzco basin with special reference to glacial forms, it is concluded (1) that the beds belong to the Pleistocene series; (2) that the bones were deposited during a period of pronounced alluviation; and (3) that since the deposition of the bones at least 75 feet of gravel was deposited over them and later partly eroded, an erosion that is still in progress and to whose activity we owe the exposure.

It should be remembered that while compelled to refer the gravel beds of this locality to the Pleistocene series, I have yet to determine their place in that series. When this is done the antiquity of the vertebrate remains may be more safely approximated than now. A provisional estimate would hardly be less than 10,000 years; it could not exceed the maximum glaciation of the last glacial period, generally estimated at 75,000 years.

The bones were soaked in melted vaseline, packed in cotton-batting and brought safely to New Haven, where they have been examined by Dr. George F. Eaton, curator of osteology in the Peabody Museum of Yale University. He finds that the fragments represent sixteen distinct bones, including a fragment of a human skull, two imperfect ribs, fragments of a pelvis and femora of at least three individuals. As there are fragments of only eight human bones, it is impossible to say much about the individuals whom they represent. Of the physical characteristics of the one represented by a femur and an associated pelvis, Dr. Eaton reports that the following logical inferences may be drawn: "We may reasonably suppose him to have been a remarkably thick-set and powerful man, about 5 feet 4 inches (1·625 m.) in height. As his skeletal characters are not sufficiently primitive to differentiate him specifically from *Homo sapiens*, he should be provisionally referred to that species. Such a course will also comply with your request that the identification of this material should be made without regard to any purely geological indications of age."

Among the eight other fragmentary bones is a much-battered shaft of the left tibia "from the skeleton of a wolf or wolf-like dog." There is also the "cannon bone" of the left hind leg of a bovine animal together with a fragment of the right radius and a fragment of the first right thoracic rib. While the exact specific identification of the three last-named

specimens must rest largely on the determination of their geological age, "there is no doubt," says Dr. Eaton, "that they are either from the bison, *Bos americanus*, or from one of the closely related species." If these bones do represent the bison, it is, I believe, the first instance from South America. The remainder of the collection comprises four more or less fragmentary bones that "are confidently referred to *Lama guanacus*, the guanaco, the feral species from which the domestic breeds of the llama and alpaca are supposed to be derived."

Although the bones belong, possibly without exception, to the present-day fauna of the new world, the geological evidence points to the possibility of the remains being of glacial or inter-glacial time. Further examination of the region where these bones were found is needed before we shall be able to speak more definitely about their age. There have been several reports from placer gold-miners in the central Andes of arrow-heads and bones having been washed out of what the mining engineers supposed was glacial gravel. But direct evidence for glacial man in South America is so unreliable that reputed discoveries should not be accepted without the utmost caution.

The bones brought home by the expedition will be presented to the Peabody Museum of the Yale University, together with photographs taken by Prof. Foote. It seems to me quite possible that the bones and the before-mentioned wall will be found to belong to the same geological period, whatever that may be.

In conclusion, it should be remembered that our work was largely reconnaissance exploration. We hope to send out other expeditions to make thorough examination of the more important discoveries.

NOTES ON THE IBO COUNTRY AND THE IBO PEOPLE, SOUTHERN NIGERIA.

By the Rev. GEORGE T. BASDEN, M.A.

WHEN, in the autumn of 1900, I first arrived at Onitsha, the information at one's disposal concerning the neighbouring country was distinctly limited. What knowledge existed was very circumscribed, and was mostly locked up in the minds of a few individuals. Maps were of little avail, as none had up to that time been compiled giving reliable data, and the characteristics both of the Ibo country and the Ibo people were more or less matters of conjecture.

Notwithstanding the fact that Europeans have been in touch with the Ibo people since the ill-fated Niger expedition of 1841, and missionaries have been working amongst them for over fifty years, yet it is only during the last decade, *i.e.* since the administration was taken over by the British Government, that any definite knowledge has been gathered of the country and the people dwelling beyond the limits of the trading

* Map, p. 312.

factories and mission stations, confined previously almost entirely to the towns adjacent to the river-banks.

Towards the close of 1900 I was able to traverse the country lying between Asaba and Ab-wor (Agbor), on the western side of the river, and I have since paid a few visits to that part of the protectorate; but the intervening years have been spent chiefly in the hinterland of Onitsha, and it is concerning this district that I venture to offer these notes and the accompanying prismatic route survey.

It will be convenient at this stage to describe the method adopted in the construction of the survey. The fixed point is at Awka, from whence the routes radiate for the most part. The "1-furlong general direction" system was in no single case followed, but every angle, however long or short the distance, was taken on a 4-inch Cary Porter prismatic compass. The greatest care was observed in securing as accurate a reading as possible, it being unnecessary to rush matters, for the work attempted has been done simply as a recreative hobby, which one hopes may prove of some use to others, even as the exercise entailed in taking the field-notes has been beneficial to the author. The reading having been carefully noted, the distance was measured by pacing, the number being counted by at least two, and often the distance was paced twice. The length of the paces was checked by regular measurements, and as an instance of the consistent length thereof, the number of paces over 3 measured miles works out at 1955, 1954, and 1958.

The next endeavour was to follow routes which would divide the country into rough triangular sections, and thus make one route cut the other at known points. Errors thus discovered were distributed over the entire distance traversed and one section completed before another was commenced. The nature of the country passed through was carefully noted and all the place-names written in, the spelling being based on a long acquaintance with the Ibo language. No heights were measured by me, partly because no instruments were available for ascertaining them, and partly because the hills are insignificant in the country covered by the survey. The few heights given are taken from Captain W. H. Beverley's map.

In submitting the map, no claim is made to having produced anything of great scientific value. It is but a humble contribution to the records of the Society which perchance may give some better and clearer ideas of part of the country lying to the east of the Niger.

The following notes dealing with the country itself and the Ibo people may also prove acceptable.

As far as can be ascertained, the Ibos form probably nearly one-half of the total population of Southern Nigeria, their numbers being computed to be something over 3 millions. If this turns out to be a true estimate, then it will be conceded that such a tribe must be taken into consideration when dealing with the peoples of West Africa. And not

only do their numbers compel attention, but their characteristics and customs provide abundant scope for interesting study.

The limits of the country occupied by the Ibos have now been fairly clearly defined, the territory has been apportioned into districts, and a considerable number of Government stations have been established. Missionary and trading centres have also greatly increased in numbers of recent years. The sketch-map given as an inset on the map shows approximately the area covered by this tribe, and it will be observed that they are distributed over a large section of the protectorate. In the delta districts, especially in the neighbourhood of Bonny and other coast towns, the Ibos are not indigenous. They consist chiefly of slaves, but apparently they outnumber the original inhabitants, and their language has shown so much vitality that Bonny Ibo predominates generally over the other dialects of the district.

From the coast-line of the bight the country inhabited by the Ibos passes round the borders of the Ibibis, Aro-Chuku, and Efik tribes until its eastern boundary is contiguous with the Cross river. On the western side, after encompassing the Ijaw and other tribes, it spreads across the Niger to the confines of Benin. After passing parallel 6° 30′ N. lat., the Ibo country narrows in once more and extends in wedge-like formation, its northernmost limits running up to the boundary between Northern and Southern Nigeria, where the Akpotos and Munshis become the immediate neighbours. The area covered by this tribe being so extensive, it follows naturally that there must be widely divergent variations in the features of the country. In the lower or delta districts the land is flat and intersected in all directions by waterways, and is little more than swamp for a large part of the year.

When travelling up the Niger, the first rising ground is met with in the neighbourhood of Onitsha. Striking inland from this point in an easterly direction, the scenery changes quickly and pleasant hills and valleys extend on all sides. In these districts there is very little forest, the country consisting generally of open scrub and moorland. Wherever extensive clumps of trees are observed, it may be taken for granted that they denote the localities of either towns or burial-grounds, the old custom being always to preserve a dense belt of bush around the towns for defensive purposes. The soil is of a red sandy nature, and very inferior in quality, necessitating much labour in cultivation and producing even then but comparatively poor results. Yam and cassava are the principal crops grown, and these form the staple food of the people, supplemented by maize, beans, gourds, breadfruit, etc.

On the western side of the river the aspect of the country changes considerably. A great part of the country is covered with primæval forest, and in many instances clearings have been specially made to establish towns and to provide land for agricultural purposes. The soil is much more fertile, and immense crops of yams are raised with very

little effort beyond clearing the ground and keeping down the weeds. Timber is plentiful, mahogany and iroko being the most valuable and useful, the latter being almost providentially serviceable on account of its resistance to the attacks of the pestiferous white ants, so prolific in these regions. Yams growing so freely, very little cassava is cultivated, and the people hold such food in the greatest contempt.

Flowers do not appear in any quantity, the best being several species of lilies and orchids. The oil-palm (*Elæis guineensis*) flourishes in a greater or less degree, according to situation, throughout the Ibo country, and the *Raphia vinifera* and other palms provide the natives with copious supplies of palm wine; they also supply materials for house-building and other useful purposes.

For Africa, game of every description, barring fish, is exceptionally scarce. Guinea-fowl and partridges are few and wild; deer of different varieties are to be had occasionally, as also buffalo. In some of the rivers and creeks the manatee makes its home, and its flesh is highly prized by the natives. The thick hide is cut into strips, twisted into spiral form and dried, and then used as canes. Hippopotami and crocodiles also abound in the quieter waters. Leopards are occasionally troublesome, and there are several smaller species of the cat tribe. A considerable trade in ivory used to be carried on, and the people speak of elephants, but it must be some years since any were seen. In any case, the Ibo country is no hunter's paradise. This scarcity of game is due, no doubt, to the fact that for generations every man possessed a gun, and until quite recently powder was easily obtainable. The practice was to kill and slay at every opportunity, throughout all seasons of the year. The country being comparatively thickly populated, especially some parts on the eastern side of the river, the result of this indiscriminate slaughter is that the country has been nearly denuded of its game—a loss which will take some years to rectify. The hippopotami and crocodiles have fared better, since the guns and ammunition were not sufficiently powerful to bring about any appreciable diminution of their numbers.

In certain towns and districts monkeys have been allowed to become a positive nuisance, owing to their being regarded as sacred animals, and to kill one brought the slayer under terrible forfeits. In like manner, the fish of many streams are sacred, and may not be caught or killed on any account. The writer has seen shoals of fish swimming unconcernedly amongst the women filling their waterpots. Iguanas, crocodiles, pythons, the tortoise, etc., in different towns, are regarded in a similar way.

In outward appearance the people vary considerably, due, most probably, to local conditions. On the eastern bank they are inclined to be thin and scraggy, consequent upon having to work harder for their food, and its being of inferior quality and less abundant than is the case with their brethren on the western side. There the folk show every indication of being well-fed, and are disposed to be fat, heavy, and lazy. Differences

in colour are very noticeable, all shades of black and brown being met with from light olive to the deepest ebony tint. Albinos are found everywhere, and, as may be imagined, are not of prepossessing appearance. They are spoken of as "Ndi-awca," *i.e.* "white people," and are not looked upon in any way as freaks or treated as monstrosities. Amongst the elders skin disfigurements are quite common, especially upon hands, legs, and feet, these parts of the anatomy presenting, in consequence, a piebald aspect.

The Ibo country lying as it does within the territory forming the recognized Negro belt, the people bear the main characteristics of that stock, although certain variations are not uncommon. Whilst flat, bridgeless noses are general, yet there are often to be found individuals with straight nasal organs, but the wide open nostrils prevail almost without exception. Many of the people have well-shaped heads, the skulls often being manipulated more or less during infancy. Naturally possessed of good teeth of a strong type, they frequently spoil them by chipping and filing, and, incidentally, make themselves hideous. The children are very attractive and provide unfailing amusement. During the earlier years of maturity, both men and women possess good figures, and they are lithesome and graceful; but as a rule they tend to degenerate at an early age, this being especially so in the case of the women. From the physical point of view, the Ibo may be summed up as a typical child of nature. Apparently extremely loth to exert himself, yet one is bound to acknowledge that he has a great capacity for endurance. As a matter of fact, the labour entailed in tilling the soil and the national pastime of dancing result in the production of splendid muscular power. The physical strain required to execute a series of movements in some of the set dances is tremendous, and only such as have witnessed these performances can form any adequate idea of the enormous strength and endurance demanded of the dancers. Many of the acknowledged "ikolobia"—"young athletes"—are magnificent specimens of muscular development.

The Ibos possess all the inherent love of things ornamental in common with other savage peoples. Every conceivable article of dress or otherwise is brought into requisition as apparel, from the proverbial top hat to an umbrella cover, taken from the frame and the stick hole enlarged to admit the passing through of the owner's body, and thus providing him with a sort of ballet skirt. In ornamenting the body itself they go back to more primitive methods. A rough system of painting and tattooing prevails throughout the country, with the exception of an occasional town here and there. For the former, fresh indigo dye is applied together with various vegetable stains. This is a special feature amongst the womenfolk, and many are remarkably clever in freehand design. Each does the other in turn, the pattern being stipulated in accordance with the lady's fancy. The decorations, when done properly, extend over the whole body, and much patience is required by both the artist and the subject of the

decorations. The latter lies down in a convenient attitude and often falls soundly to sleep whilst the artist proceeds with her task. The indigo juice is squeezed out into a little wooden tray, and is applied with a pointed stick or, amongst the more skilful designers, with a small iron instrument curved to a degree which almost exactly corresponds to the sweep of a liner's pencil when pulling a down-stroke. Hence they are able to set out clean-cut lines and curves. After a few hours the dye assumes a deep black hue and will not wear off for several days.

The second method adopted is a permanent one, viz. that of cicatrization, and it is extensively practised throughout the Ibo country. The process is as follows: Chalk is rubbed over the skin, and the design lined in with charcoal. Small incisions are next made in the flesh along the lines of the pattern at short intervals. The skin is raised and tiny pads of cotton are inserted. Finally charcoal is smeared all over the part operated upon. For several days the incisions are prevented from healing by artificial irritation, thus inducing small sores to form, the idea being to produce eventually slight black protrusions above the surrounding skin.

Tattooing of the face is another system almost universally followed, a practice which gives the person so decorated a grotesque appearance. It is performed by cutting a series of small gashes on the face with a triangular razor, and then rubbing in charcoal, or vegetable dye, or lamp-black. This tattooing differs in style considerably, each town having its own peculiar pattern, constituting what are known as the "ici" or tribal marks. It can scarcely be designated as other than an ugly disfigurement.

In tracing the sources of many Ibo customs, the investigator cannot help being struck with the similitude between them and some of the ideas and practices of the Levitical code. The people are intensely religious. A casual observer might pronounce them superstitious, but the fact is, the belief in the spiritual exercises a profound influence over every detail of their lives. Their religion is not an idolatrous one as that term is commonly interpreted, the idols, so called, being merely tangible symbols to assist them in the service and worship of the invisible. As a natural outcome of their beliefs we find the practice of sacrifice prevails all over the country, and to it, of course, can be traced the offering of human beings in sacrifice.

To take another example, we find that circumcision is universally practised among the Ibos; entirely so as regards males, and nearly so as regards females. The time when the ceremony is performed differs in each district; in certain parts it takes place a few days after birth, in others it is not carried out till the age of puberty. The original idea of the custom has been lost; it certainly has no connection with religious beliefs at the present time.

In language some of the idioms met with approximate very closely to the Hebrew tongue. The combination of the infinitive with the noun in Ibo is very common, *e.g.* "To murmur a murmur," "to die the death,"

etc. With very few exceptions intransitive verbs have no place in the Ibo language. What affinity, if any, this language may have to the languages of the circumadjacent tribes remains to be properly investigated. Space does not admit of a discussion of the general laws of the Ibos beyond stating that practically all property is entailed. Land is inalienable from the family, and though leased or loaned can always be reclaimed by the owners at will. The head of the family holds the property in trust for his lifetime, and is bound by strict limitations in the administration thereof.

Sufficient has been said, perhaps, to arouse some interest in this great tribe. The Ibo-speaking people are now under British protection, and consequently the savage customs of cannibalism, human sacrifice, infanticide, etc., are being gradually swept away. With the advance of education through the agency of the Government and missionary societies, a new civilization is springing up, but if the sociological upheavals are to prove really beneficial they must be directed into right channels.

There is a vast amount to be done in developing the Ibo country, and England's responsibility is a heavy one in dealing with one of the greatest and most virile tribes in her West African possessions.

EXPERIMENTS ON THE SETTLEMENT OF SAND IN RUNNING WATER.*

By Dr. JOHN S. OWENS.

As the experiments described in my last paper before the Department—published in the *Journal* for January, 1911—dealt only with settlement in still water, the present paper deals with an attempt to determine the rates of settlement of different grades of sand in a current of water, and is a description of certain experiments undertaken with this object in view. As the results obtained are contrary to what might have been expected, it will be necessary to go somewhat carefully into the several factors which might affect these results.

The generally accepted theory is that a particle of higher specific gravity than water will settle to the bottom at the same rate in running as in still water, provided there are no eddies or disturbances, and the motion of the water is strictly stream-line in form. As a purely stream-line motion is seldom or never likely to be found in natural rivers, it follows that natural streams have a somewhat eddying flow, and the inference would be that the rate of settlement in such would always be somewhat slower than that in still water.

In planning out these experiments it was not a case of adopting the best method; but rather the best which circumstances permitted, and as it was soon found impracticable to aim at a direct measurement of the time of settlement in a running stream, an indirect method was adopted, based on the following general principle. If a stream of known depth and of measured velocity carried a grain of sand a certain horizontal distance while settling, the time and rate of settlement could be calculated; then if the fall of sand of the same grade in

* Research Department, January 18, 1912.

still water at the same temperature as the stream was timed, the rates of settlement in running and still water might be compared. There were, of course, many points which had to be considered, but this illustrates the principle worked on. Through the kindness of Mr. Hamon Lestrange, I had access to a small river running through his property at Holme, Norfolk; and here the experiments were made.

Details of Method adopted.—In order to measure the horizontal travel of a sand grain the following method was devised:—

A board 11 inches wide and 4 feet long was marked transversely on one face by a series of very small ridges or corrugations, running across from side to side and covering the whole face of the board. These ridges were spaced accurately a quarter of an inch apart, crest to crest, and were shaped somewhat like sand-ripples, having a vertical face and a sloping back. The height of the ridges was about a sixteenth of an inch from crest to trough; and it was intended to make these trap the sand grains as they fell, in the same way as sand ripples trap particles of shingle. The ridges were numbered 1 to 192, and the board was provided with four projecting nails on its edge which fitted into slots cut in four stakes: the stakes could be driven into the bed of the river, and the board fixed horizontally to the stakes on or near the bottom, with the vertical faces of the ridges facing upstream. In order to avoid eddies the stakes supporting the board were fixed, two at the downstream end, and two a foot upstream from there, so that 3 feet of board projected unsupported upstream of the stakes. The board was only about five-eighths of an inch thick, so that its upstream edge would not cause much disturbance. Having fixed this board in the bed of the stream and carefully levelled it with a spirit-level, a mark was fixed vertically over the upstream end, or in some cases 1 foot further upstream, and a plumb-bob hung just clear of the water to give a mark for dropping in the sand. A heavy plank crossing the stream at this part made it possible to do this without placing obstructions in the water. In making an observation, the current velocity was first taken by means of a "velocity rod," weighted so as to float vertically in the stream with its lower end just clear of the board, the intention being to get the mean velocity by direct observation; several runs of this were timed and the average taken, each run being about 4 or 5 feet long, as the current was slow, and the path directly over the board. Having obtained the velocity, the temperature was taken, and then a pinch of graded and numbered sand dropped carefully into the water, or rather set free at the surface under the plumb-bob. This was done very carefully, the sand being first moistened and then rubbed into the water at the surface, grain by grain, between the finger and thumb, so as to make certain no lumps of sand fell in, but separated grains; if a lump fell in the experiment was abandoned, the board cleared, and a new one done. When the sand had settled, the number of the ridge on the board which contained the first group of grains was read by means of a roughly made water-telescope, which prevented the surface-ripples obstructing the view. Thus the velocity of current, depth of water, and number of corrugation the sand grain rested in were known.

calling v = velocity of current in f.s,
d = depth in feet,
c = number of corrugation the grains lodged in,
r = rate of settlement of sand in f.s.,

then, since each ridge on the board is $\frac{1}{4}''$ wide, the horizontal travel of a grain will be $= \frac{c}{48}$ feet, and the time required to travel this distance at the velocity of

the current will be $\frac{c}{48v}$ seconds, which must also be the time required for the sand grain to fall through the depth d; the rate of fall in f.s. will therefore be $\frac{48dv}{c}$. In the case of a particular experiment with sand 0·036 inch diam., where the depth d was 18″, velocity v was 0·37 f.s., and the sand lodged in the ridge number 69, the rate of settlement was $\frac{48 \times 1{\cdot}5 \times 0{\cdot}37}{69}$ or 0·386 f.s. This is to illustrate the method adopted.

There were, however, two things which had to be considered before basing conclusions on this method. The first was the fact that the sand grains do not settle from surface to bottom with a uniform velocity, but have an accelerating stage at the start; if this accelerating stage was long enough it would invalidate the above reasoning, which assumes a uniform rate of fall from the start. It is very important, in view of the results obtained, to note further that any effect which the neglect of the accelerating stage in the fall of the grains would have would be in the direction of lengthening the horizontal travel of the sand and giving too slow a rate of settlement as calculated from this travel. A preliminary experiment was made to find if the accelerating stage could or could not be neglected. Two sand grades were taken, the larger about $\frac{1}{8}$ inch diam. and the smaller about $\frac{1}{40}$ inch diam., really a little smaller, as they were graded through sieves of 8 and 40 meshes per inch respectively. The largest grain it was intended to work with in the current was chosen, as in it the accelerating stage would be the longest, therefore its effect would be greatest. These two grades of sand were timed when falling through water in a $\frac{3}{4}$ inch glass tube; (*a*) through the first 30 inches from surface, and (*b*) through the first 60 inches from the surface. As the whole accelerating stage was obviously included in the first 30 inches of fall, the time of falling through this part should be more than half the time of falling through 60 inches, if the accelerating stage was important enough to make any difference. Five runs were made with the $\frac{1}{8}$ inch sand, and these gave a mean rate of fall through the first 30 inches = 0·549 f.s., and through 60 inches = 0·546. Clearly, therefore, the error introduced by neglecting the effect of acceleration was more than swamped by the errors of observation, and might be neglected. In the case of the $\frac{1}{40}$ inch grain the mean rate of fall from eight runs through 30 inches was 0·237 f.s., and through 60 inches 0·233 f.s., so that it was considered, with sand below $\frac{1}{8}$ inch diameter, the effect on the accuracy of the results of neglecting the preliminary accelerating stage of fall was so small as to be entirely within the limit of experimental error, and would not therefore affect the result.

The second point which had to be considered was the effect of the accelerating stage of motion with the current. The sand was at rest when placed in the current, and had to be accelerated up to the speed of the current; the question was what, from a quantitative point of view, would be the effect of this on the horizontal travel. It is important to note that the effect on the distance travelled would be to reduce it below what it would be had the sand moved off from the start with the speed of the current, and thus the effects of the two accelerations considered would be in opposite directions. However, to find what this effect might amount to, the distance which the sand would travel horizontally during the period of acceleration was calculated and deducted from the distance which it would travel at the uniform velocity of the current, in order to find by how much the observed travel might fall short of the true if acceleration were neglected. For this purpose the largest grain experimented

with was used so as to obtain the maximum effect; that is, a grain 0·05 inch diameter in a current 1·11 f.s. It was found that the reduction in horizontal travel due to this cause amounted only to about 0·18 of an inch for the whole accelerating stage. Hence it was considered safe to neglect it also, since apparently the total error would not amount to more than 1 per cent. from this cause alone, and considering that the effect of the accelerating stage of the fall operated in the opposite direction, the effect of both combined must be less than of either alone. In fact, when the rate of settlement of the sand in still water is the same as the current velocity the horizontal travel is unaffected, the distance covered being the same as if the sand fell at a uniform velocity and moved forward at the full current velocity.

Experiment I.—In this silicious sand from the seashore was graded through sieves and numbered, and the diameter deduced from the number of meshes per inch, deducting the thickness of the wires. It is probable that this method gives somewhat different results from measurement direct by microscope and micrometer, as used in experiment (2) to be described, the sieves probably measure the smallest diameter and the micrometer the largest; as grains can pass a mesh endwise, whereas they lie on a microscope slide with their greatest diameter horizontal, also the meshes were probably not all strictly the same size.

The corrugated board having been fixed and levelled, the depth, velocity, and temperature measured as described, the sand was dropped in, and the number of the ridge the first group occupied on the board noted. On returning home the same sand grades were timed through a four-feet fall in a $\frac{3}{4}$-inch glass tube full of water at exactly the same temperature as the stream. The results are worked out and embodied in Table I., only final results being given.

Column (1) gives the reference number or grade of sand.

Column (2) gives the diameter of grain in thousandths of an inch obtained as described.

Column (3) gives the rate of settlement in still water, each observation being the mean of about five runs, which differed very slightly from each other.

TABLE I.—EXPERIMENT (1).

Comparing the rates of settlement of different grades of silicious sand in running and in still water from separate experiments made with each grade of sand in running water on August 12, 1911, and in still water Dec. 27, 1911.

1	2	3	4	5	6
Grade No.	Approximate diameter in thousandths of an inch.	Rate of settlement in still water f.s.	Rate of settlement in running water f.s.	Velocity of current f.s.	Temp. ° Fahr.
1	103	0·715	0·814	0·37	70°
2	80	0·631	0·697	,,	,,
3	43	0·527	0·565	,,	,,
4	37	0·379	0·386	,,	,,
5	18·8	0·265	0·268	,,	,,
6	15	0·217	0·224	,,	,,
5	18·8	0·265	0·266	0·327	69
6	15	0·217	0·234	,,	,,
7	12	0·163	0·171	,,	,,

In obtaining the rate given in column (4) a mean of five or six separate runs or experiments with each grade was taken.

To give an idea of the regularity of the results—the times of fall of grade 4 through 4 feet in still water and measured in fifths of a second were 52, 50, 53, 55, 54 respectively. Also, with the same grade in the current, in five runs the sand lodged respectively in corrugations number 68, 69, 69, 69, 69, having been dropped in over number 0.

In both the current experiments and the still water the first grains of a group only were noted, since these represented the largest and most spherical; the reasons for this were gone into in my last paper of January, 1911.

It was found in doing Experiment I. that with the finer grades of sand it was very difficult to see the few isolated grains resting on the board which represented the first to fall, and there is a probability in this case that the horizontal travel of the small grades, five to seven was read too long, as the silicious grains were hard to see through the water. It is worth noting this, as owing to it some black sand was procured which was easily visible, and this was used in the next experiment.

If Columns 3 and 4 be compared, it will be seen that in all cases the rate of settlement in the stream was greater than in still water. This appears a most extraordinary result, and its explanation is one of the things which it is hoped the discussion will throw light upon. Of course, the first possibility which will no doubt occur to all is that of error in observation or method. I have gone carefully into the matter and cannot detect any source of error to account for the anomaly, and it may be here stated that the results are consistent with those of four other experiments I have to describe. It is owing to this that the effects of acceleration have been considered at some length.

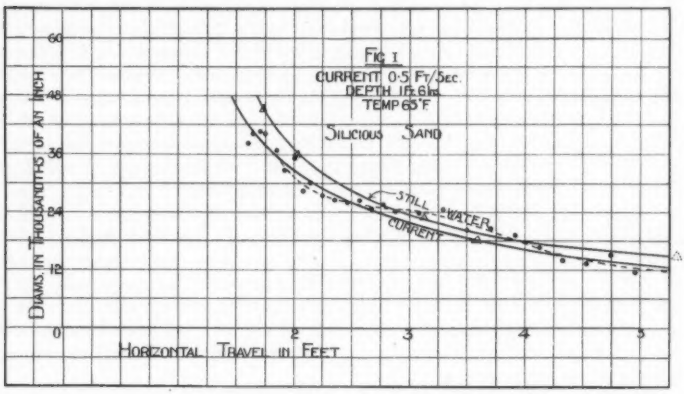
Experiment II., August 16, 1911.—Settlement of black sand. In this a heavy black sand composed of rounded and polished grains was graded so that a sample was obtained which passed a sieve of 40 meshes per inch and was held on a 50-mesh sieve. The approximate diameter of the largest grains in this was 18 thousandths of an inch. This was dropped carefully into a current as described under Experiment (1). The current velocity was taken by a velocity rod, and three runs over 5 feet each gave exactly 10 seconds, and therefore a velocity of current (mean) of 0·5 f.s.

The temperature of the water was 64·5° F., and depth to surface of board 18 inches. Four trials were made with the sand, and the number of the ridge on which the first grain or group of grains rested was respectively No. 69, 65, 67, 73, average 68·5. As the sand was dropped in one foot upstream of ridge No. 0 on board, this gives an average travel of 2·43 feet, and a rate of settlement of 0·308 foot per second.

In order to compare this result with the rate of settlement in still water, the same grade of black sand was timed over a 4-feet fall in a ¾-inch glass tube filled with water at the same temperature as the current—64·5° F. The time of fall measured in fifths of a second on a stop-watch was for five runs respectively 72, 71, 72, 74, 72, average 72·2, which gives a rate of settlement of 0·277 foot per second. In this case, also, the first grain or the head of a group of grains was timed, and an initial fall of one foot allowed before commencing to time. The rate of settlement in running water as calculated by the method described was 0·308 f.s. as against only 0·277 f.s. in still water, being an increase of about 11 per cent.

Experiment III., August 16, 1911.—I now tried a somewhat different method, which gave a great deal of information with less trouble than those

previously adopted. Having provided myself with a sample of sand of all grades from about one-eighth inch diameter down, and of mixed silicious and black grains, the corrugated board was fixed in the stream as before, and levelled; the depth, velocity, and temperature were measured; and then, at a point 1 foot upstream of corrugation 0, I carefully dropped in the mixed sand. The grains sorted themselves out, and the large settled near the upstream end, the small towards the downstream end of the board. The next step was to lift the board carefully out of its supports, without disturbing the sand, and to measure the diameters of the grains and note the number of the corrugation they rested in. To measure the diameters a micrometer microscope was used measuring to one five-hundredth of an inch, and about five grains in every fifth or tenth groove were measured, the mean being taken as the diameter of grain in any particular groove. Further, the most spherical grains were chosen, so as to eliminate the effect of flatness, since a large flat grain would possibly settle at the same rate as a small spherical grain. In noting the results the black sand was kept separate from the silicious.

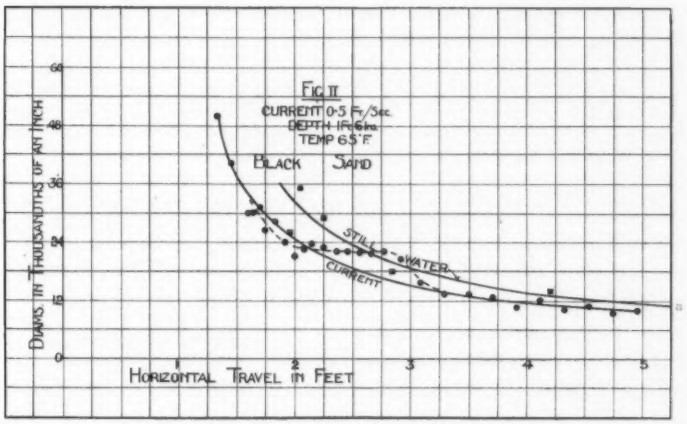


The results of this experiment are given in the form of a curve, in which the horizontal travel of each size of grain is plotted against its diameter. In order to obtain a comparable figure for still water to plot with these the rates of settlement of the same sand in still water at the same temperature as the current were obtained experimentally; then, assuming that the grains settled at the same rate in the current as in still water, and taking the depth and current velocity as in the experiment in the river, I calculated the horizontal travel; this distance was plotted for each sand grain against its diameter on the same sheet with the actual travel in the current, and both are shown for the silicious sand in Fig. I. It will be seen that the distance travelled horizontally in the current was less than that as calculated from the rate of settlement in still water at the same temperature. In other words, in this experiment also the rate of settlement in the current was greater than in still water, both obtained as above indicated.

The results obtained with black sand are given in Fig. II. The sand used was black or dark brown, probably ferruginous, with polished rounded grains, and there was no difficulty in picking out and measuring the black grains when

mixed with silicious on the board. In this case also special measurements were made of the rate of settlement of the sand grains in still water at the same temperature as the current in which the board experiment was made. The sand was so very uniform in size of grain that I could not get a sufficient number of the larger grains to measure the rate in still water by noting the travel of the head of a group of graded sand, so in these cases I had to use single grains measured by the microscope micrometer, choosing rounded grains; so that the results obtained are more irregular than they should be. I also suspect that the individual grains may vary in specific gravity, which would also tend in the same direction.

As in the case of the silicious sand, the horizontal travel as actually obtained in the current is plotted in the curve, Fig. II., against the sand diameter; and the theoretical distance which the sand would travel if it settled at the same rate in



the current as in still water is plotted from the still-water results for each sized grain.

In this case also the sand travelled a shorter distance in the current than it should have done if settling at the same rate as in still water; the inference apparently being that it settled more rapidly in the current than in the still water.

All the experiments I have described were made in a little river about 12 feet wide and 1 foot 6 inches deep. The current was very slow and steady and the bottom muddy. The experiments were made in the middle of the stream, and the board rested on the bottom. There was probably a considerable retardation of the bottom layers of current owing to weed, but the neighbourhood of the board was cleared of weed. The velocity of the current did not exceed 0·5 foot per second.

Experiment IV., August 24, 1911.—In order to get a current of higher velocity I had to go to a part of the river where it flowed over a sandy bed, across tidal flats; and here I obtained a current of 1·11 feet per second; but the depth which I could use was only 8 inches.

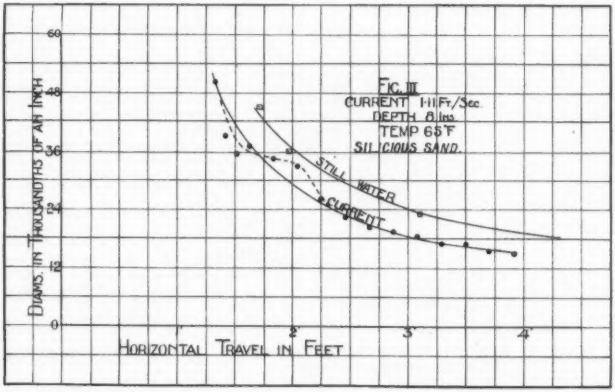
The velocity of the current was measured as before, with a rod-float nearly reaching to the board, timed over a 6-foot run; the average of five runs being

taken. The temperature of the water was 65° F., and mixed silicious sand was dropped in one foot upstream of the board. When the sand had settled the board was carefully removed, the diameters measured, and number of corrugation the grains rested in noted.

The results are given in the curve, Fig. III., in which the horizontal travel both actual and theoretical as calculated from the rate of settlement in still water is plotted against the diameter of sand grain.

In this case the same curious result appears; that is, the apparent rate of settlement in the current is more rapid than in the still water, and further, the difference is greater than in the case of the slower current experiments.

In this case when the diameters were measured I preserved the board with the sand grains on it by running thin size over it and letting it dry, so that the grains were stuck on that you might be able to see exactly what happened.



On examining the board it will be seen that the coarse sand is near the upstream end (the vertical sides of the ridges faced upstream). The difference in rate of settlement due to shape of particle is also clearly brought out, for large flat grains are found in the same groove with small spherical ones, thus showing that both settled at the same rate. A flat grain and a spherical one of the same diameter are never found in the same groove. From this it is clear that the flat grains settle more slowly than the spherical of the same diameter. The same effect is seen with irregularly shaped grains; they are always found further downstream than the spherical grains. The smallest grain, therefore, in any groove is the most spherical.

Another curious result obtained in this experiment was that on removing the board it was found to be sprinkled evenly from end to end with very fine sand, of from 2 to 6 thousandths of an inch diameter. This made it impossible to rely upon picking out and measuring the sand dropped in when below about 11 thousandths of an inch in diameter. The most interesting inference is, however, that this very fine sand was suspended in the water; the quantity was so small as to be invisible to the eye on looking into the stream, as this appeared quite clear. This fine sand could not have got on to the board from the sample I dropped in, as it settled too slowly, and it was found in the grooves with the coarse and fine grains alike. The river was surrounded by

weed-grown, muddy, tide flats, and hence it could not be blown sand. It would therefore seem that this current of 1·11 f.s. was able to pick up and hold in suspension sand of from 0·002 to 0·006 inch diameter.

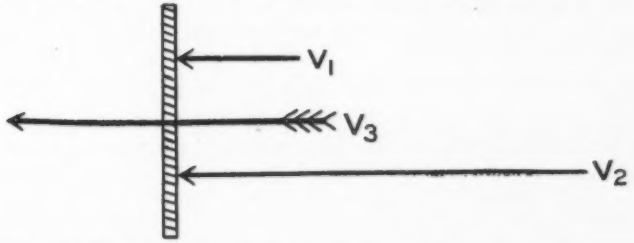
Sand of such size formed part of the bed of the river, and was the smallest size of grain on the bed. In another place in the river where the depth was 6 inches and current 2·11 f.s., I trapped in a vessel near the surface of the water grains from 0·002 to 0·008 inch diameter.

Turning now to a consideration of results obtained in Experiments I. to IV., the most curious is the apparently increased rate of deposition in a current. It is obvious, that should this prove to be correct, it can only hold good under certain conditions. A very rapid current, full of swirls, will certainly suspend particles of higher specific gravity than water and thus reduce their rate of settlement; and in the case of Experiment IV. apparently large grains had their rate of fall increased, while those of 0·006 inch diameter were suspended. If it could be showed that the method of measuring current velocities by means of rod-floats gave too high a mean velocity it would explain the results obtained, as it would make the rate of settlement calculated from the rod-float too high. I cannot, however, find any evidence that the velocity rod does not give a practically true mean velocity. A. Cunningham, in his 'Roorkee Hydraulic Experiments,' gives evidence that the rod velocity is a very close approximation to the mean velocity, but states that "the rod velocity is, within limits of practice, always somewhat *less* than the mean velocity past the immersed portion of the rod." Unwin and Merriman, in their books on Hydraulics, support the statement that the rod velocity is a very close approximation to the mean.

I have worked out an elementary case of a body exposed to currents of different velocity and give the results here, as they also show that the rod will travel at a velocity which is the mean of those of the currents it is in. When a current of water strikes an immersed body the pressure may be calculated as follows:—

Let V = velocity of current in f.s., G = density of water, A = area of face exposed to current in square feet, and P = total pressure due to current. Then $P = \frac{KV^2GA}{2g}$, K being a constant depending on the shape of the body. This may be written $P = CV^2$, where C is a new constant $= \frac{KGA}{2g}$.

Considering a body of negligible thickness placed in a current, the upper part travelling at a velocity v_1, the lower v_2, and so that the plane of separation divides the surface into two equal parts thus (v_2 being greater than v_1),



and let body move with current at a velocity v_3, then—

F = driving force $= C(v_2 - v_3)^2$, since body moves faster than v_1 and slower than v_2.

R = Resistance = $C(v_3 - v_1)^2$. The question is what value of v_3 will make F − R = O, as the body will move at this velocity. To find this, equate F to R. Thus—

$$\begin{aligned} C(v_2 - v_3)^2 &= C(v_3 - v_1)^2 \\ v_2^2 + v_3^2 - 2v_2v_3 &= v_3^2 + v_1^2 - 2v_3v_1 \\ 2v_3(v_1 - v_2) &= v_1^2 - v_2^2 \\ v_3 &= \frac{v_1^2 - v_2^2}{2(v_1 - v_2)} \\ &= \frac{v_1 + v_2}{2} \end{aligned}$$

which means that the body will travel with a velocity v_3, equal to the mean between v_1 and v_2.

There seems, therefore, to be no reason to suspect the velocity of the current in the experiments as being other than the true mean. The known fact that the velocity of a stream reduces from near the surface to the bed would seem to provide a reason for expecting a spherical body to travel *further* horizontally in such a current when falling through a given depth than if the current were uniform throughout. The particle falling from a rapid current into a slower one will always tend, by its inertia, to retain the velocity attained in the rapid layer, and so one would expect its velocity of translation to be a little higher than that of the mean velocity of the current.

The only explanation which I can suggest is this: I showed in my paper in the *Journal* of January, 1911, that bodies settling through still water dispose themselves so that the greatest diameter is horizontal, the effect being that flat sand grains settle more slowly than grains of the same weight and specific gravity, but more spherical shape. That being so, if there is any factor operating in a current to disturb this disposition of settling grains, its effect must be to increase the rate of settlement; that is, if a grain settles at its slowest rate when its greatest surface is horizontal, any departure from this state must increase its rate of fall.

Now, in all streams the current is most rapid near the surface, and gradually reduces towards the bed; therefore a body falling in such a current will have its upper half exposed to a more rapid current than its lower half; there must therefore be a tendency for such a body to spin on a horizontal axis. This tendency can be observed in the case of a rod-float, as it does not lie vertically in the current, but with its upper end in advance of its lower. If, then, a settling sand-grain is caused to spin on a horizontal axis when in a current, it cannot dispose itself to settle at its slowest rate as it would in still water. The couple tending to cause a grain to spin would probably not be effective with very flat grains; but in these experiments such grains were neglected and the more spherical measured, none of which, of course, were true spheres.

Another inference from this is that spherical grains would be unaffected, and would settle at the same rate in running as in still water as far as this factor is concerned. It is a curious coincidence that the only grain of sand which I have noted as being a sphere did give the same rate of fall in still water as obtained in the current for grains of the same diameter; that is, the grain on Fig. II., which has a diameter of twenty-six thousandths of an inch, and is plotted as a square dot.

In conclusion, I have to acknowledge my indebtedness to Mr. Lestrange, Mr. Algernon Hervey, of Hunstanton, and Mr. Eric Lestrange, of Heacham, for

facilities given me to do the experiments; to Mr. N. F. Mackenzie for his valuable suggestions, to Mr. E. Wells for his voluntary assistance in making the observations, and to Mr. Pocock, my assistant, for his help both in making observations and working out results.

I should also like to say that I was most ably assisted by my wife in carrying out the experiments and making notes.

Prof. MYRES: We are met this afternoon to discuss a paper by Dr. Owens on some "Experiments on the Settlement of Sand in Running Water." The text of the paper has been circulated to members of the committee, and I will ask Dr. Owens to communicate to us briefly the points on which he would most value discussion.

The following letter was read from Mr. Philip Lake, after the paper:—

"In both Dr. Owens' series of experiments on the fall of sand-grains—in still and in running water—the rate of settlement is deduced from the fall of the first grains that reach the bottom. His experiments, therefore, prove conclusively the interesting fact that in running water some of the grains fall more rapidly than any of those in still water. But they do not show that the average rate is different.

"If a flattened particle is placed in a current in a slanting position with the lower edge up-stream, the current, acting upon its upper surface, will tend, for a short time at least, to make it fall more quickly than in still water; and the difference will be greater as the current is more rapid. This agrees with Dr. Owens' results.

"If, on the other hand, the particle slants in the opposite direction, the current, acting on its lower surface, will tend to make it fall more slowly; but such particles would not be observed in these experiments.

"I do not offer this as more than a suggestion; but it would be interesting if Dr. Owens, with the ingenuity that he has already shown, could devise an experiment to determine the average rate of all the grains. In default of this, observations of the last as well as of the first grain would be of some value."

Dr. STRAHAN: It has occurred to me that the black and white sands are composed of different materials. This may have been taken into account, and I will merely mention that the black sand is chiefly composed of small grains of iron-oxide, the white sand of small grains of quartz, and that the specific gravities of these materials are different. It would be a good test of Dr. Owens' methods to make experiments with black grains only, and again with white grains only, after noting the specific gravity, and to observe the difference in their behaviour.

Dr. OWENS: That is what I did. The black was compared with the black and the white with the white.

Dr. STRAHAN: Did you take the specific gravity? That should be done. Then the explanation of the slower fall of particles in still water than in moving water, which is founded upon Dr. Owens' experiments in illustration of the fall of cylindrical and other bodies, was exceedingly interesting and ingenious; the tendency of rods or discs to get, while sinking, into a position of greatest resistance is most marked. If this explanation is correct, the accelerating influence which is due to the movement in the water putting the grain out of the position of greatest resistance should not be observable when the grain is spherical. Now, it is easy to separate the sand-grains into spheres, rods, or discs, and observations on the behaviour of each would be likely to form a test of the truth of Dr. Owens' explanation.

Mr. LAMPLUGH: These experiments are of interest to all geologists. There is one question I might ask. The sand-grains were dropped in the current of an open stream. Did I understand aright that the other grains, allowed to fall in still water, were dropped into an enclosed vessel, and not into a still part of the same stream? If so, there might be some little difference in the conditions.

Captain LYONS: I have had no experience in experiments of this nature, but there are two or three points on which I should be glad if Dr. Owens would give us some further information. These experiments are, of course, restricted to a small field, a few feet long and 18 inches or so deep, but the results are instructive. In his paper mean values are usually given, but in one case we have the individual observations; it would be valuable if he would state in every case the degree of agreement in some form, either as the greatest departure from the mean, or so as to give an idea of the degree of agreement between the five experiments. It would also be convenient to form an additional column to show the percentage increase in the velocity of fall to which he refers. The sand exhibited contained both black and other coloured grains, so I would inquire whether the black grains were specially sorted out, or whether the sand was used in the mixed state. Regarding the curves which he has exhibited, I should like to know whether those curves were free-hand curves drawn arbitrarily among the plotted points, or whether points on the curves were calculated from the points obtained by observation. I should have been inclined to shift somewhat the position of the curve in at least one case. In the determination of velocity, I presume the rod was always placed in the stream at some point above the measured distance, so it had taken the velocity of the water. I hope Dr. Owens will give us references to such similar work as has been done elsewhere, with which he is sure to be perfectly familiar.

Mr. A. E. KITSON: The transport of material in swift streams flowing through very sandy country is an interesting question. The investigations that Dr. Owens has made are admirable, but should be extended before some of the actions of currents can, I think, be satisfactorily explained. To regard as negligible the accelerated motion in the upper portion of the stream seems hardly advisable. The strips of water embraced in the experiments, and the highest velocity—under 0·8 mile per hour—of the streams tested were small. It would be interesting to have experiments made at different depths in streams with currents up to 3 or 4 miles an hour. There might be great difficulty in seeing the finer grains falling, or in getting the board out of the water without disarranging the sand on it; but such experiments seem necessary before the greater velocity of the upper section can be disregarded. While wading in streams with suspended sand, I have noticed that, when ascending the stream, sand fell into the back parts of the boots, and when descending it fell on the toes. This was evidently due to diminished velocity of the water of eddies formed on the down-stream side of the legs. The sand used in the experiment appears to have shell fragments and limonite, as well as quartz. These are of different specific gravities and shapes, and so the results may be affected. It is remarkable that the larger flat grains fell into the same grooves as smaller rounded ones. Might this be due to slight deflections of the current turning the narrow edges of the flat grains opposite to it, and thus hastening their deposition? Have any experiments been made with regard to the action of eddies and deflections of current? In the streams tested there were practically ideal flows. But this does not ordinarily occur in swift streams, and the general scientific value and economic application of empirical

results would be enhanced if these points were determined. One frequently sees a part of a stream with a placid surface suddenly bulge without apparent cause. This is not due to a snag or suspended organic matter, but appears to be due to the formation and demolition of ridges or patches of sand in the bed. It is so due in swift shallow streams with sandy bottoms; deeper streams may be similarly, though less, affected. Thus it appears that the influence of eddies and deflections should be ascertained.

Mr. N. F. Mackenzie: I should like to say something about Dr. Owens' most ingenious explanation of the reason for the increased rate of settlement in running water. I agree with the reason he gives, but I do not think that he goes far enough. I am inclined to think that particles of silt, in passing from the top of the stream to the bottom, are really acted on by a downward current, and that is the reason why they pass so quickly It is not only gravity, it is also the current acting upon them. To my mind, the point about the experiments which is rather significant is that the measurements were made in the middle of the stream. Now, if we take the action of water flowing in an open channel, we know that on the surface there are currents from the edge inwards. At or about the centre of the stream these currents are deflected downwards—that is to say, at the centre of the stream we have a more or less vertical current acting downwards. At the bottom of the stream the currents are from the centre of the stream outwards to the edges, and at the edges of the stream we have vertical currents from the bottom upwards. In other words, there is a sort of a double vortex in a running channel. The experiments could be very easily checked by taking observations at the sides of the stream, because there we should have the rate of settlement retarded by the vertical upward current. If my theory be true, we should expect to find that the rate of settlement increases as the mean velocity increases. There is one curious point I should like to draw attention to in Table I., that is the figures relating to grades 5 and 6. We have in grade 5, rate of settlement in still water 0·265, and the rate of settlement in running water 0·268, the mean velocity of the current being 0·37. Now, in grade 5, when the mean velocity of the current diminishes to 0·327, we find that the rate of settlement in running water is only 0·266. The mean velocity has decreased, and the rate of settlement has also decreased. If we take grade 6, we find the opposite—the rate of settlement in still water is 0·217; in a current of velocity 0·37 we have the rate of settlement 0·224. When the mean velocity diminishes to 0·327, we ought to find the rate of settlement less; but it is greater, viz. 0·234. These grade 6 results conflict with the theory I have advanced.

This investigation is of very great value to any one having to deal with the design of open channels, such as irrigation channels. In that case we are not so much interested in the actual rate of settlement as in the minimum mean velocity, which will just be sufficient to prevent settlement. I do not know whether Dr. Owens from his figures could arrive at that, but it is the important point, and from the point of view of an irrigation engineer, would be of very considerable value. One of the previous speakers asked for references to other experiments. I might mention those of Mr. R. G. Kennedy, which are given in vol. 119 of the *Proceedings of the Institution of Civil Engineers*.

Mr. W. Coldstream, Indian Civil Service (retired): Elaborate experiments—these interrogations of Nature—such as Dr. Owens has described, are necessary to arrive at great results. I am here to-day, not because I have studied the question of deposit in its initial stages, or its principles, such as Dr. Owens has

laid before us, but because I was attracted by the title of the paper. I have been long in India, and can speak as a witness of the *results* of deposit of silt in very large areas.

The district of Hoshiarpur lies at the foothills of the Himalayas. The Siwálik range runs right through the northern part of the district between the rivers Bias and Sutlej. In them we have a range of low hills of very sandy material. In the rainy season they are subject to violent downpours of rain, which have the effect of washing away the sand and detritus of these hills into the torrent-beds which scar their sides. The sand is carried in large volumes down into the plains below. The district of Hoshiarpur is one of the most fertile in the Punjab, but it has been very seriously affected indeed, both as regards the profits of the agriculturist (whose crops are extremely valuable —sugar-cane and others), and also as regards the Government revenue, which is assessed on the land. During the thirty years which elapsed between the first and second settlement of land revenue in that district it was found that something like 50,000 rupees (= say £3330) per annum had been lost to Government by torrential action spreading this sand over culturable land. This was a very serious matter, and remedial measures had to be considered. I had the advantage at that time of the friendship, co-operation, and advice of Mr. Baden Henry Baden Powell, the eldest son of that very able and, I may say, imperially useful family, he being then Inspector of Forests. He went over some of the ground with me. He had studied the question of denudation and afforestation (Reboisement) in some of the Maritime Departments of France, and was familiar with the question of torrential action, and the remedies there applied, and I had seen his writings on the subject. It was evident it was a case where afforestation was necessary. Reports were submitted by both of us to the Government of the Punjab in 1877, I think. About twenty-five years afterwards the question had matured, and the injury to the culturable area had proved itself to be so serious and persistent that legislative action was eventually taken, and the Punjab Land Preservation (Chohs) Act was passed. These sandy torrents are called chohs. They are active, for the most part, only in the rainy season; in the cold season only a trickle of water runs through them. I am very glad to have this opportunity of instancing here the result of a deposit of silt on a very extensive scale, and hope that the experiments now being made by Dr. Owens may have some practical result in enabling us further to cope with these very serious devastations. In studying these questions, I found it desirable that we should have some nomenclature for the kind of action which was necessary in order to preserve the land on the hillside. The nearest word I could find to it in the vocabulary in use was "protective forestry." Now, that is rather a long phrase, and does not cover the whole ground, and I considered whether we could not find a word which would serve the purpose which would express exactly what was meant—the conservation of land. I may say it is not only from the action of water in that district that we lose arable land, but also from the action of wind. This sand which is scattered over the plains by the chohs is driven by the strong winds of the hot season over the fields, and this also results in agricultural loss, which has to be prevented, if possible. It has seemed to me that there is wanted a word to express the conservation of land—the protection of land from these influences—and I have suggested the word *geoterēsis* (γεωτερήσις) (I suppose it would come to be called *geoterĕsis*, following the English rule of throwing back the accent as far as possible). In considering the question, I thought of *geophylaxy* and *geophylactic*, but that seemed

an awkward word. I thought also of *geoplastic*; but on the whole I considered *geoterēsis* best. I lay these suggestions before the Society, and am glad to have this opportunity of doing so. Perhaps what I have said may show what vast results follow from such beginnings and elementary action as have engaged our attention in listening to Dr. Owens.

Mr. A. F. Lindemann: It struck me about these small ridges on the board that they produce upward currents and eddies, and consequent disturbing effects. It would be useful to employ a tank with glass sides and a cinematograph. If matter was dropped in the fluid of various regular shapes, starting with ball-shape and ending with sand of various sizes, and if cinematographic pictures were taken during their fall, the whole subject might be cleared up by slowly reproducing them. I am prepared to interest myself in the matter if Dr. Owens wishes it.

Mr. William S. Lockhart: Dr. Owens said that the temperature of the water had an appreciable effect on the results, but he did not say in which direction. The experiments with falling particles in still water have interested me very much; it, however, seemed to me that the tube used—I think it was five-eighths inch diameter—was very small. To get correct results the water space ought to be infinite, because it is clear that the displacement caused by the falling of the particles will set up eddies and currents between themselves and the confining walls of any tube, which must interfere with the effect of natural fall. All things are relative, and if only a very small amount of sand is used, the effect may not be appreciable, but a point will very soon be reached when actual surging will take place, entirely vitiating the results. The great difficulty in all experiments of this class is that, having apparently satisfactorily established the physical conditions for the test, the introduction of the material to be tested sets up an altogether new set of conditions, entirely altering its character. This is a state of things for which the investigator must be constantly on the watch.

Dr. H. Lapworth: I had an opportunity this afternoon of going through this paper, and was struck by the main principle brought out by these experiments. The first thought that occurred to me, having had some experience in measuring current velocities, was that it was due to some error possibly in measuring the horizontal velocity, and that there might also be a slight down current carrying the particles towards the bottom. One could test these suggestions by comparing the ratios of columns three and four; if there were any error in the measurement of horizontal velocity it would show as a constant ratio in each case. But I found that there is gradual decrease in comparing the two vertical velocities, starting with about 11 per cent. for the large particles and coming down to about 1 or 2 per cent. for the small particles. So that it appears evident that there is some law that has something to do with the actual *size* of the particles, causing them in running water to settle quicker vertically than in still water. The explanation of the phenomenon, however, was difficult to find.

Mr. T. Crook: I would like to suggest, as the best explanation of the results obtained by Dr. Owens, that the more rapid subsidence observed by him to take place in moving as compared with still water may be caused by, and not in spite of, the minor eddying movements that must inevitably exist in a natural stream. Eddying flow is the normal condition of stream movement. I use the term "eddying flow" in a general sense for the irregular motion characteristic of normal stream-movement. The essential factors involved in the subsidence of a sand-grain in such a stream are the size, shape, and

specific gravity of the grain, and the intensity of the eddying movement. Dr. Owens' results indicate that, for grains of a certain size and specific gravity, and for eddying flow of a certain intensity, subsidence is accelerated by stream movement. The degree of this acceleration diminishes with the size and specific gravity of the grain, owing to the fact that with diminishing size, the diminution of the mass of the grain is proportionately greater than the diminution of its surface resistance. Ultimately a limit is reached, beyond which the surface resistance is so great in comparison with the mass that the influence of gravity is overcome by that of the eddying movement, and the grain cannot subside. The small grains referred to by Dr. Owens as not put into the water by him, fall into this latter category. They were gratuitously provided by the stream with which he was experimenting, and in which they had been brought along in suspension owing to the ineffectiveness of gravity upon them as compared with their surface resistance, a circumstance which placed them at the mercy of the eddying movement of the water. I was struck by the fact that Dr. Owens' "black sand" apparently consisted of limonite grains, and that they were smooth and very well rounded, as, indeed, he admits to be the case. In spite of the approximate sphericity of these grains, their rate of subsidence in the stream was considerably greater than that in still water; and the excess in this case appears from the results to have been even greater than that in the case of the quartz grains having an approximately similar diameter. This important fact is strongly opposed to Dr. Owens' explanation that absence of sphericity is the cause of the more rapid subsidence in the moving water. On the other hand, it would be well explained by the inference, to which his results seem to lead, that in the eddying stream which he used, the downward components of the eddy-movements were more effective in accelerating subsidence than were the upward components in retarding it, for grains of that particular size and specific gravity. At all events, whatever may be the real explanation of Dr. Owens' interesting results, the explanation which he has given, though very simple and plausible, is quite at variance with his facts.

Mr. WALLACE: Has Dr. Owens tried reversing the board? It did not seem to me quite the same shape, or has he tried a board with different corrugation? For this reason, an error of one corrugation in the observed place of the first particle might be an error of over 1 per cent.; taking the illustration given here of grade 4 where the corrugation is number 69, that might account for the difference in columns 3 and 4 in this particular grade, where the difference is only about 2 per cent. If there was any retardation or any acceleration due to the corrugations, so that it affected the result to one-quarter of an inch, it would make that difference. The figures in columns 3 and 4 are given to an accuracy of three significant figures. It does not seem to me—I may be wrong—that the last figure in those results is reliable owing to the experimental error in the observations. If that be so, the results for grade 5 are practically identical in both cases where the currents differ.

Mr. F. J. GRAY: I have listened with very great interest to the description of the experiments which Dr. Owens and his accomplished wife carried out, and I just want to ask one or two questions. In comparing the fall in moving water and still water, was the same water used? That is to say, in the still water experiment was the water used from the stream? I think also it would be interesting to add to these tables the specific gravity of the water used. The rate of settlement is really the average velocity, I take it.

Dr. OWENS: As several speakers have referred to my method of getting the velocity in still water in a glass tube, I will deal with that first. I described in

my last paper the method by which I found the smallest diameter of tube I might use. I took two tubes, $2\frac{1}{2}$ and $\frac{3}{4}$ inches in diameter, and timed the rate of fall of the same particles in those two tubes side by side. The rate of fall should be the same. As soon as the rate of fall in the small tube began to be reduced, as compared with that in the larger tube, then the diameter of the small tube was beginning to affect the result. I found that until the diameter of the tube was less than about four times the diameter of the sand-grain there was no effect. In the case I am now dealing with the sand was one-eighth of an inch diameter, and the tube diameter three-quarters of an inch; you will see it was therefore greater than four times the sand diameter. The objection can only be raised to the largest or approximately eighth-inch grain, whereas nearly all the experiments now described dealt with grains from one-eighth of an inch down. In reply to Dr. Strahan, I intended to make it clear that the black and the silicious sand were never compared together. The black was compared in running and still water with itself, not with silicious. I could not get the specific gravity very easily because the sand was mixed up, and I had no specific gravity solutions. In the method of observation adopted I was able to neglect the white grains, and simply took note of the position of the black grains on the board, neglecting the silicious particles. In obtaining the rate of fall in still water, I dropped in a mixture of sand containing black and white grains, but took no notice of the white, and therefore got the results for the black sands. I found the black sand always went ahead of the white—it was heavier; it settled more rapidly. There was not very much silicious sand mixed with it, but there was enough to make it impossible to get the specific gravity without separation. If my explanation as to rolling over and over is correct, it would fail in the case of spheres. Somebody said that the fact that the black sand, which was very rounded, showed the same results as the silicious was against my explanation. When I said rounded I meant that the grains were not angular—there were a few almost perfect spheres. The grain might be very rounded but still be flattened, and such a grain had the opportunity of settling down with its greater diameter horizontal. If it rolled over and over it might get up a higher speed than if settling with its greater diameter horizontal. Mr. Lamplugh also referred to the glass vessel experiment. I think I am safe in saying that the vessel did not affect the rate of settlement of the sand in this case. In reply to Captain Lyons, I would have stated the degree of agreement between the times of the different runs, but the paper was getting too long. As a matter of fact, several of the experiments which have been suggested I have already done. I carried out a series on the effect of temperature to determine the quantitative effect on sands of different diameter. Further, I carried out experiments somewhat similar to those which Mr. Mackenzie suggested, on the rate of travel of sand along the bottom in the form of ripples.

In reply to Mr. Kitson's remarks, of course the experiments which I have done are quite rudimentary, and, so far from giving grounds for final conclusions, indicate rather the necessity for more work along similar lines. It is an extremely difficult thing to experiment with, and many of the difficulties I have not dealt with prominently. I was not in a position to devise the best possible method and use it, but had to devise a method which the circumstances permitted me to use. There were certain conditions which I could control: the method used had to fit in with those conditions. I should very much like to extend the work, and carry out the experiments at higher velocities and greater depths; but you will note that in the paper results for four different velocities

are given. The time of taking the velocity was criticized. There is no error in that, because most of the experiments only took about one minute to do. When once the board was in position and the velocity was taken, the dropping of the sand did not take more than a minute. The velocity did not vary much. I took it in most cases before and after the experiment. Again, although the sand was mixed with shells and bits of flat stones, there was no difficulty in neglecting them in the experiments. It was perfectly easy to distinguish a piece of small shell from the silicious sand. As to the action of eddies suggested by Mr. Kitson, I did not quite follow his explanation why an eddy which is operating both ways must have less effect in the upward direction than in the downward. It seems to me that unless there is some spreading of the eddy so as to reduce its velocity, the effect will be about the same, and that such reduction of velocity usually acts in favour of keeping matter suspended. The effect of eddies on the sand travelling over the bed I have not been able to deal with in this paper, but, as referred to in answering Mr. Mackenzie, I have taken observations on the rate of travel of the sand ripples, and the eddy of course is the governing factor in that case. Mr. Mackenzie has advanced a reason why particles might settle faster in a current than in still water, and since it depends on the supposition that my experiments were done in mid-stream, I am sorry to have to say that one of the experiments was done at the side of the stream, *i.e.* No. IV. Further, with reference to the spherical particle which I referred to, that was only a single observation, and very much cannot be based upon it; it was also an observation of a single grain only. As to the mean velocity which would prevent settlement. You will notice, I think, in the last experiment I did something in that line. The current through which the sand dropped in was settling apparently carried in suspension very fine sand; and further down the same stream a current of a little higher velocity carried in suspension sand a little coarser. Mr. Lindeman's suggestion of a glass channel would, I have no doubt, have been a very much better method of carrying out the experiments. Unfortunately, I was unable to do anything of that kind. In planning what I proposed to do, I considered the possibility of using tanks with glass sides, in which you could watch what was going on, but I had to make the best of what was within my reach. As to the temperature effect, the higher the temperature the higher the rate of settlement; and it has a very marked effect, so much so that a very small sand-grain will settle perhaps twice as rapidly at 80° as at 50° Fahr. As to the travelling up and down the tube of little particles, I have often observed it myself; in fact, it was one of the greatest difficulties I had to deal with in doing the temperature experiments. When the particles were very fine, and I tried to get a tube full of water at a given temperature, I found it was impossible to prevent serious errors from convection currents; the outer part of the tube always developed a downward current, with an upward current in the middle. Very often I could see a particle go down the middle very slowly, then suddenly get to the side and go down very rapidly.

Mr. Lapworth suggested a possible error in the method of measuring the velocity of current. I do not think there is any error in the velocity rod method. I worked it out very carefully, but did not find any indication that it would give a velocity other than the true mean, and the various runs fitted in together; there was very little discrepancy between one run and another. I think there may be some law which I have not found at the moment; but the main thing, I think, about the whole experiments is, that there is something curious, something strange about the results, the explanation of which is not obvious. The question then is, is it true? Have we to look for an error

in the experiments, or an explanation of a true natural fact? Mr. Crook has also referred to eddy currents. I do not see why an eddy current should hurry the rate of fall of a body, unless you can be sure that the body is longest in the downward part of the eddy. There is no reason why it should be so. As to the objection based on the smaller grains being less affected, I think that fits in equally well with my own explanation. The smaller ones would, I think, be less affected in that case; that is, if the increased rapidity of settlement is caused by the spin due to impact of the different layers of the current on the lower half and the upper half of the particle. It is true that when due to the width of the corrugations, the error in the larger grains is a higher percentage than in the smaller. This does not explain anything, unless you can show that the error is always in the same direction. There is a possible error of a quarter of an inch, that is, the travel may be taken too long by a quarter of an inch. As to the last significant figure, I do not think it is a very important figure, and of course there is some experimental error, the amount of which I am not able to say. Mr. Gray asked, was the water the same in the current and still water tests? It was not; but I do not think this would have any effect, because in my last paper I made an experiment on settlement of grains in sea-water and in fresh water, thinking I should get a great difference, but I did not get any; so surely the difference between the fresh water of a river and the fresh water of the main which I used is negligible. I have no hydrometer which will measure the specific gravity sufficiently accurately to detect any difference in the specific gravity of the water I used in the tubes and the water of the current.

In view of Prof. Myres' and Captain Lyons' remarks, I have drawn on each figure, in dotted lines, a curve which follows as closely as possible the individual observations on travel in a current. These lines have a curious wave-like shape, which was neglected in drawing the original full line "current" curves.

Prof. Myres: I congratulate Dr. Owens on the admirable paper he has given us, and the way it has provoked debate. We have had a longer and more helpful discussion than usual. In one of Dr. Owens' diagrams the irregular disposition of his observed points suggests at first sight some modification of a pulsatory kind in the velocity; for although the curve which he deduces from his observations is a simple curve, he had nearly all his observations on one side of his line in one part of it, and on the other side in two other parts. I hope that it will be possible to take advantage of the suggestion of Mr. Lindeman to make use of the new facilities for mechanical observation afforded by the cinematograph. That would be a distinct improvement in accuracy of record, and in the variety of observations which could be taken. I think we should also include in the thanks we express to Dr. Owens some expression of the help which has been given by his friends in Norfolk. It is not everybody whose friends have a private river, and it is not everybody who has a private river who allows his friends to measure the sediment at the bottom.

REVIEWS.

EUROPE.

'The Place-names of Lancashire.' By H. C. Wyld. (London: Constable. 1911. Pp. xxiv., 400. 26*s*.) The author of this volume acknowledges the collaboration of Dr. Oakes Hirst. The book opens with a review in five short

chapters on the scope and method of the inquiry, and the chief sources of Lancashire place-names. In the rest of Part I., the names themselves are arranged in alphabetical order under the modern form. Various early forms are then given with their dates and sources, and the meaning is analysed from these. In certain instances it appears that well-known derivations have been omitted, and some of these might perhaps have been included, if only to be disproved, as the study of place-names is one which has continually to contend against popular error. In Part II. an analysis is given, again in alphabetical order, of the principal elements which occur in the place-names studied. The book is therefore most conveniently arranged for reference.

'The History of the Forest of Exmoor.' By E. T. MacDermot. (Taunton: Wessex Press. 1911. Pp. x., 480. *Maps and Illustrations.* 21*s.*) The first chapter of this volume affords a short survey of the forest in its physical aspects, with a special reference to the changes which these have undergone within historic times. The forest laws are subsequently dealt with, and the history of the tract is treated in detail from the thirteenth century onwards. A number of old maps are provided, among which the most interesting is that given as a frontispiece, which dates from 1675, and is in the nature of a diagram showing the moor roughly as a circle, with a series of village churches ranged round it. The author's researches have resulted in the publication of numerous records for the first time in this book.

'The Danube.' By W. Jerrold. (London: Methuen. 1911. Pp. xiii., 315. *Illustrations.* 10*s.* 6*d.*) In this volume the author follows the Danube from source to mouth, giving a careful account of every place of any considerable historic interest which is passed by the river, together with a description of villages, towns, and scenery. Fair illustrations in wash and colour are also provided, and for the most part they illustrate their subject well, but that of the Iron Gate is not very effective. The description of the physical characteristics of the river are excellent, and the whole book may be read much more profitably than many others of its kind.

'Avignon' ('Mediæval Towns' Series). By T. Okey. (London: Dent. 1911. Pp. xiv., 408. *Maps and Illustrations.* 4*s.* 6*d.*). The standard of this well-known series will certainly suffer no lowering through the present volume in respect of either the text or Mr. Percy Wadham's sketches. Avignon takes high rank among the world's towns, not only in historical but also in architectural interest, and both sides are fully treated by the writer. The modern map is adequate in enabling the reader to follow the description; in comparison with this plan a perspective of about 1650 shows certain interesting survivals (apart from the greater buildings) in the topography of the place.

'A Tour through Old Provence.' By A. S. Forrest. (London: Stanley Paul. *N.d.* Pp. 288. *Illustrations.* 6*s.*) This is a pleasantly written book with more body in it (if the expression may be allowed) than is found in many works of the same type. The writer shows knowledge of the local history not only of the great towns but of lesser sites, and he presents clearly the scenic setting of his studies. The drawings are successful when they portray characteristic human figures, but the style is ill suited to architecture and scenery.

'With Ski in Norway and Lapland.' By J. H. Fulton. (London: Warner. 1911. Pp. xv., 254. *Maps and Illustrations.* 5*s.*) This writer has been very far afield in pursuit of his pastime, for he not only visited Christiania, as many do for winter sports, but also explored Jotunheim and other parts, and went as far north as Tromsö; he also followed the railway from Narvik to Kiruna and Gellivara, and he and his party had the opportunity of being present

at one of the great church meetings of the Lapps. He has much of interest to say about these people, and his expedition appears to have been wonderfully successful.

'Two Thousand Miles on Foot.' By E. W. Fox. (London: Walter Scott Publishing Co. Pp. xiii., 317. *Illustrations.* 6*s.*) This author describes various walking tours made by him in northern France and Great Britain, and his narrative will doubtless be of interest to those who follow his example on holiday. The two English tours cover the whole distance from Land's End to John o' Groats. The illustrations are not in all cases worthy of reproduction, and the errata noted at the beginning of the book do not represent the total of misprints.

ASIA.

Arabia.

'The Land of Uz.' By Abdullah Mansur (G. Wyman Bury). *Illustrated.* London: Macmillan. 1911. 8*s.* 6*d. net.*

This is a book of alarms and excursions, of hairbreadth escapes and stories, which have lost nothing in the telling, and at the same time of much information which has been gathered as probably no other living Englishman could have gathered it. The author has led a strange life of adventure—not that he here tells us anything explicitly about it, until he came to be employed as an intelligence officer by the Aden Boundary Commission and Field Force—and has lived some part of it very much as an Arab among Arabs. Even a reader who knows nothing about him or his history, except what the book tells, will feel that his knowledge of South-West Arabian society is so peculiarly intimate that he could have told a great deal more about it had he chosen. There is an atmosphere round the book—the sort of atmosphere which Kipling has often tried to create with his familiar *aposiopesis.* "But that's another story!" It is a suggestive atmosphere, which one suspects of emanating sometimes from not over-savoury experiences. It is not always *virginibus puerisque*—at least, not for well-brought-up British ones; but it serves both to pique the reader's curiosity and to gain his confidence whenever native men and manners are in question. The author's dare-devilry may not have appeared always to others as he would have it appear to his reader; his adventures may not always have been just so and not otherwise (if we do him injustice, he must blame the rather swaggering tone in which he has told some of them, and his patent assumption of the character of a desperado), but that he has gone where he says he has gone, done more or less what he says he has done, and seen, in the main, what he says he has seen, we do not question for a moment.

He throws so much light on so many obscure events and places that no serious student of Arabian geography and history can neglect his book. It is tragic to think how many such students, if English, will be irritated, and, if foreign, be puzzled, by his manner of narration and yet be bound to read him! For no one else has penetrated as far over the Kaur—the watershed north of the Yafa and Fadhli countries—as Mr. Bury, or at least no one has written about the region beyond. He went not only to Nisab, but to Behan, which is within touch of Marib, in that hinterland of Yemen which was once the seat of Sabæan power. He seems sure that, to get to Behan, he crossed a bit of the mysterious Rubaal-Khali, the "abode of emptiness," as the Arabs call the terrible sand waste which fills more than half the south of the peninsula. If he did, that great desert stretches further both to west and south than

geographers have concluded from the reports of other travellers; but if Mr Bury was really told by his guides that the land strip south of Behanal-Jezab is a tongue of the main waste, and if he is not using the name Rubaal-Khali loosely to include any outlying desert area met with towards the fringe of the Red desert itself, the maps must be corrected.

Altogether a curious book by a curious man, of whose singular qualifications for advancing knowledge of Southern Arabia it ought to be possible to make further use, as General Maitland indeed urges in his preface. The Royal Geographical Society has tried to avail itself of his services, but the attempt ended in a miscarriage, the responsibility for which is not easy to assign. He is well known also both to the War Office and the Indian Government, and he is still quite young.

D. G. H.

TRAVELS THROUGH THE WESTERN BORDERLANDS OF CHINA.

'Les Derniers Barbares' (China, Tibet, Mongolie). Par le Commandant d'Ollone. Paris: Pierre Lafitte. 1911. 15 *fr.*

In this volume Major d'Ollone gives a general description of the journey in China, Tibet, and Mongolia, made by himself and his three companions—Captain de Fleurelle, Captain Lepage, and Lieutenant de Boyve—in 1907–1908, to which frequent reference has been made in the *Journal*. After two months spent in ethnographical work in Cambodia, Cochin-China, Tongking, and on the frontiers of the Chinese province of Kwangtung, the party proceeded to Yunnan-fu, where, on April 15, 1907, the journey as recorded in this volume was begun.

This journey may be conveniently divided into three parts: (1) a passage across the northern portion of the independent Lolo country on the left bank of the Yangtse, followed by a visit to the Lolos on the right bank in the north-east of Yunnan. This stage was undertaken by Major d'Ollone and Lieutenant de Boyve, accompanied, during the first part, by Père de Guébriant, well known for his knowledge of and success in dealing with the Lolos; (2) travel in country inhabited principally by Miao tribes in the east of Yunnan and west of Kweichau provinces. This was carried out by Captain de Fleurelle and Captain Lepage; (3) travel through the Chienchiang valley, northwards *viâ* Chengtu and Sungp'an into the lands of Sifans and nomad tribes of Tibet to Lhabrang monastery, thence to Lanchou and north-eastwards to Peking. The journey is illustrated by excellent photographs, and accompanied by four maps, three giving route sketches of the three stages, while the fourth is a general map of the whole journey.

Major d'Ollone supplies new and interesting details of the Spartan simplicity and rudeness of life of the Lolo chiefs, who owe their position entirely to personal vigour, prowess in warfare, and the resources of their particular clan or group of clans. War appears to be the end and aim of Lolo desire. These fierce and hardy mountaineers not only harass one another, but make constant raids upon neighbouring Chinese villages, whose inhabitants they not infrequently carry away as slaves. They despise agriculture and industrial arts, which are carried on by their serfs and slaves. They are fine horsemen, and their national arm is the lance, 15 to 20 feet long. Major d'Ollone appears to regard the north-east corner of Yunnan on the right bank of the Yangtse as "the cradle of the Lolo race," and considers them to be serious rivals of the Chinese in the impending struggle for the possession of the wild lands to the west. We may remark, however, that it is not improbable that this fine

warlike race migrated from the region of the Tung-t'ing lakes in Honan, westwards through the north of the provinces of Kweichau and Yunnan, about the second century B.C., under Chinese pressure. At an earlier date, they may have come from the south of the Koko-nor into the province of Honan, and have been gradually forced southwards by the Chinese advance. The limits of space make it impossible to do more than refer thus inadequately to Major d'Ollone's graphic and sympathetic description of the independent Lolos.

At Suifu, on the Yangtse, the party met the French gunboat *Olry*, which a short time previously had successfully negotiated the dangerous rapids between that town and Pingshan, generally described as the navigable limit for junks on the Yangtse.*

The second stage of the journey—exploration work among the Miao—being accomplished, the two parties met again at Yunnan-fu for the final march northwards to Peking. This stage took the mission again in the direction of the rich and fertile Chienchiang valley, whose heights are still held by the Lolos in spite of Chinese endeavours to dislodge them. Mosso tribesmen were met,† and Major d'Ollone measured several individuals. He gives their stature as exceeding 6 feet 6 inches. Leaving Ningyuan-fu in the Chienchiang valley on December 28, 1907, the expedition proceeded to Tachienlu and Chengtu, and on April 24 a start was made from Sungp'an, the door into the Sifan country. Under the term Sifan (literally, western barbarian) Major d'Ollone points out that the Chinese mix up all peoples said to be of Tibetan stock in these regions. The area beyond Sungp'an is known as the Grass country. Six inches of snow commonly fell at night or in the early morning, but by 10 a.m. had disappeared, evaporated into the dry air and licked up by the wind. The sources of the Min river were noted at an elevation of 14,000 feet. The passage of the Tengona pass (14,000 feet) brought the travellers into the basin of the Yellow river. With the last glimpses of the mountains of China they arrived in the Dzorgue confederation of nomad tribes occupying the top of the loop of the Yellow river. Brigandage is rife here. The winter village of Pan-yu, at which the party halted, had been visited eight years before by the ill-fated expedition of Messrs. Watts-Jones and Grant Birch. Major d'Ollone gives valuable and interesting information on the Lamaist monasteries in this region. His party was coldly received by the lamas, and Captain Lepage and Lieut. de Boyve were actually attacked close to Lhabrang and narrowly escaped with their lives. On reaching Liangchou, where the expedition met M. Pelliot, the leader's three companions left for Taiyuan-fu and Peking by way of the Ordos country, while he himself, taking a more northerly route, pursued his Mohammedan researches. On arrival at the sacred mountain of Wutai he met the Dalai Lama, also on his way to Peking, and was received in audience by him.

To sum up, Major d'Ollone and his companions covered over 5000 miles, of which more than 1700 had not been traversed by Europeans. The mission brought back 2000 photographs of scenery and types of natives; over 200 completed surveys; vocabularies of non-Chinese dialects, Lolo documents, and historical inscriptions in Chinese, Sanscrit, Tibetan, Mongol, Manchu, Arabic, and Lolo; besides a miscellaneous collection of arms, paintings, and coins. The scientific documents of the mission are to be contained in seven supplementary volumes—one of which, on the Chinese Mohammedans, has already appeared.

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* Pingshan had been visited by the British gunboat *Woodcock* in 1904.

† The Mossos generally are to be found more to the west, and Tibetan chronicles state that the Mossos were conquered and driven back to the south-east.

It has been here possible to give only a brief outline of Major d'Ollone's valuable and interesting work. The courage, determination, and endurance of himself and his companions are worthy of the highest admiration.

E. C. WILTON.

'Turkestan.' By W. E. Curtis. (London: Hodder & Stoughton. 1911. Pp. 344. *Illustrations.*) This American traveller journeyed over a route where permission to do so is not easily come by—the Central Asian railway. His visits to Merv, Bokhara, and Samarkand resulted in some study and good photographs of the political and economic conditions and the remains of antiquity in those cities, and he kept an observant eye on all that was to be seen from the window of his railway carriage and during his travels by other means of conveyance. We find a well-judged appreciation of Russian methods of administration in these territories, of which the writer has also studied the history. He appears to omit certain non-political considerations from his conception of a railway linking the Russian and British Indian systems through Afghanistan.

'Through India and Burma with Pen and Brush.' By A. Hugh Fisher. (London: Laurie. [*N.d.*] Pp. xiii., 358. *Illustrations.* 15*s. net.*) We prefer the products of the author's pen to those of his brush, for the coloured illustrations form some of the least successful examples of the three-colour process, with the exception of one or two which are admirable. The text is largely narrative, is easily readable, and affords a considerable amount of miscellaneous information which may be useful to travellers on Mr. Fisher's route. It may be added that he travelled in the East as artist for the Visual Instruction Committee of the Colonial Office.

'Across China on Foot.' By E. J. Dingle. (Bristol: Arrowsmith. 1911. Pp. xvi., 446. *Map and Illustrations.* 16*s.*) Mr. Dingle, who has travelled widely in the East, deals in this volume with a series of journeys extending from Shanghai to Bhamo, by way of the Yangtse-kiang and Tali-fu. So far as can be gathered from a rather indistinct map, he was in country previously unseen by a European in certain parts of Yunnan. But he carried no surveying instruments, nor was concerned directly with exploration, as his wish was rather to know something of Chinese political, social, and economic conditions from within. The book is therefore of special interest to students of these topics at the present time. But as far as concerns the less-known or unknown parts of his route there is little material of geographical service beyond a few photographs. Some of these are well-chosen views over wide areas.

'The Full Recognition of Japan.' By R. P. Porter. (London: Frowde. 1911. Pp. xii., 789. *Maps and Illustrations.* 10*s.* 6*d.*) The author has had two opportunities of visiting Japan in order to report for journalistic purposes on the economic conditions of the country. These visits took place at an interval of fourteen years, and the survey contained in the present volume is therefore of unusual interest, as such remarkable political and economic changes had taken place during the interval between the writer's visits. He covers not only Japan, but Korea, Formosa, and Manchuria. He surveys the history of the empire so far as it is necessary as an introduction to the present expansion. He has a chapter on the physical characteristics of the country, which, though short, appears to contain all essential facts, and he deals at length with every branch of administration, with economic products, with labour and commerce, and with art. The book should form a standard of reference on these topics, though on some of them it enters into such high detail that the rapid development of Japan will necessitate early revision.

AMERICA.

Canada and Newfoundland.

'Historical Geography of the British Colonies.' Vol. 5. 'Canada, Part III. Geographical.' (Pp. vii., 302.) Vol. 5, Part IV. 'Newfoundland. (Pp. xii., 274.) By J. D. Rogers. (Oxford: Clarendon Press. 1911. *Maps.* 4*s.* 6*d. each.*)

These two volumes are a notable addition to Sir Charles Lucas' well-known series. The Newfoundland volume is almost purely historical, but in the earlier part we find topics of prime geographical importance in the early discoveries and attempts at settlement. The Canadian volume, on the other hand, is purely geographical in arrangement and treatment. The three great physical divisions of the old eastern highland, the middle plains and the western mountains are explained, subdivided, and described in detail. This part of the work is highly to be commended for its clarity; only on one point it is rather difficult to follow the author—in the apparent doubt as to the applicability of the term "lakes" to Lake Winnipeg and other sheets of water in its vicinity. On the physical basis is built up the story of settlement and development, so that the inclusion of the volume in an historical series is amply justified. Some data are furnished for the distribution of settlers according to original nationality. This subject as treated by Mr. Rogers will possess an additional, retrospective interest in view of the ethnological work recently undertaken by the Canadian Government. We may also follow the process of opening up communications, by water, trail, road and rail, and, thanks to the writer's careful dating of events, are enabled once more to marvel at the extraordinary rapidity of this process in the last few decades. The publication of the volume has fallen rather unfortunately in date with regard to the use of census figures, which are mostly ten years old, but this will be easy of remedy in a further edition. References to authorities are copiously given in both volumes.

American Glaciology.

G. F. Wright, 'The Ice Age in North America and its Bearings upon the Antiquity of Man.' 5th edit. Ohio (London: C. Higham & Son), 1911. xxi. + 763 pp., ix. pls., 196 figs., 3 maps. 20*s. net.*

The appearance of Dr. G. F. Wright's 'The Ice Age in North America' in a fifth and enlarged edition shows the usefulness of the work as a general account of the glacial geology of that continent. The new edition summarizes much of the fresh evidence concerning North American glaciation, especially regarding the Western mountains, and the extension of glacial deposits beyond the line of great terminal moraine in Pennsylvania. The well-known theory of Carvill Lewis, that every sheet of land ice is limited by a terminal moraine, has been found to require revision even for the area where it was founded. The new edition includes an account of Lake Agassiz by Mr. Warren Upham. The author describes his work as "really a treatise on the whole subject of the Glacial period"; but the sections on the areas outside North America are now so incomplete that the work would have been improved by their omission. The chapter on the glacial deposits of Europe is no more up to date than the reference to "Prof. A. Geikie." The statements in regard to the Shackleton Expedition are also inadequate and unsatisfactory. The bibliography of thirty pages is irregular and incomplete, but is a useful list of American literature. The text might have been shortened with advantage in the sections dealing with theories that do not occupy the same position as they did twenty years ago. The author claims in his new preface that the later investigations "have not seriously affected the main theories adopted twenty years ago," but "pertain

mainly to the details of the subject." The value of the book would have been enhanced had the author recognized more fully the great changes that have been made in the theories that were in vogue at the date of his first edition. He devotes much space to Croll's theory of the cause of the ice age, which he describes as still the most plausible of the cosmic theories, and it is apparently this theory to which he refers as "the current astronomical theory." The author does not, however, refer to Sir Robert Ball's restatement of the theory, or to Culverwell's unanswered and apparently unanswerable criticism. Mr. Harmer's paper offering a meteorological explanation is not noticed either in the text or bibliography. The author discusses the date of the ice age, and concludes from the evidence of Niagara, the falls of St. Anthony at Minneapolis, and several interesting but less-known examples, that the ice age terminated in America from eight to ten thousand years ago.

He disputes the longer estimates from Niagara, from (amongst other grounds) his observations of the rate at which the valley is being widened by the weathering back of the cliffs. He estimates that the shale is being cut backward by weathering at the rate of three inches a year, and calculates that, at the rate of only a quarter of an inch a year, the past widening of the gorge by sub-aerial erosion could have been effected in less than ten thousand years. In the discussion upon Niagara the reference to Dr. J. W. Spencer's work seems inadequate.

There is a summary of the statements regarding the North Polar area by Peary and Cook, whose testimony, strange to say, the author appears to regard as of equal value.

The author repeats his argument for the antiquity of man in North America as proved by implements and human remains; but American opinion is apparently still doubtful of the evidence advanced by the author. The Calaveras skull and the man from the Nebraska loess are still accepted by the author as the remains of early man; but the overwhelming balance of opinion in America appears to be that these remains are those of buried Indians. Dr. Wright makes no reference to Hrdlička's monograph on the subject (*Smiths. Inst., Bur. Ethnol., Bull.* 33, 1907).

J. W. G.

Some Little-known West Indian Islands.

'A Naturalist on Desert Islands.' By Percy R. Lowe, B.A., M.B. London: Witherby & Co. 1911. 7*s.* 6*d. net.*

The author visited some almost unknown islands in the West Indies on Sir Frederic Johnston's yacht. Of these he gives us a pleasant naturalist's account of three groups, with good descriptions of their birds. Two islands, Swan and Little Swan, 98 miles from Honduras, are mainly of coral formation with coral reefs and knolls actively growing up around and between them. Both islets might be termed elevated coral reefs. The basis of Swan is an interesting deposit of a peculiar soft clay, which is formed of radiolarian ooze mixed apparently with both pelagic and bottom-living foraminifera. Abyssal oozes elevated to about 1100 feet, are also known in Barbados, Cuba, and many other West Indian islands, but it is most doubtful whether any deduction as to the existence or non-existence of land along the Panama belt can justifiably be drawn from the presence of such oozes in these islands. Little Swan in other respects seemed to be the more interesting islet, being more elevated, with several coral terraces having walls 10 to 15 feet high. Enough is told the reader to whet his appetite for more, but not enough to enable him either to accept the author's theories or to conceive others of his own.

The next island, Blanquilla, is nearly 100 miles off the coast of Venezuela, north-west of Margarita. It was visited first by Dampier in 1682 A.D., but no one has had much to say about it since. It is about 60 square kilometres in extent, with a patchy coral shore. It is peculiar in that it has a broad elongated belt of elevated coral-limestone along the east side, viz. to windward, and a central area of granite, two plateaus about 200 feet above sea-level, though the limestone had doubtless been much more denuded by rain, wind, heat and cold, etc. The granite is all cactus-covered, while the limestone is densely wooded; the shores are covered with mangroves, and there are a few coconut patches. The author compares its topography before elevation to the present form of the Aves and Los Roques islands, which lie further to the west.

The last islands are the Hermanos, close to the last. The group consists of seven cactus-covered islets of eruptive rocks, only one of which, Orquilla, was visited.

The author is not (and indeed does not profess to be) a geographer, but he is such a good observer and pleasant writer that we wish he were.

J. S. G.

'Pioneers in Canada.' By Sir H. H. Johnston. (London: Blackie. 1912. Pp. xiv., 328. *Maps and Illustrations.* 6*s.*) What with the author's facile style and copious quotation from the entertaining records of pioneers themselves, this volume ought to arouse the interests (especially among young readers) to which it appeals. The story begins with the Norse discoveries in North America, and is carried in detail down to the early years of the nineteenth century. There is a chapter descriptive of the geography, fauna, and vegetation of the Dominion, which might have served a more useful purpose if it had appeared earlier than the middle of the book, where it appears (though this is, perhaps, a matter of taste) to interrupt the narrative. Some bibliographical notes are given, and altogether the tone of the book is no less scholarly than popular.

'Highways and Byways of the Great Lakes.' By Clifton Johnson. (New York and London: Macmillan. 1911. Pp. xiv., 328. *Illustrations.* 8*s.* 6*d. net.*) One of the "American Highways and Byways" series, describing the region of the United States adjacent to the Great Lakes, beginning with Ontario and proceeding upwards. As in the case of other volumes in the series, the author aims here at giving typical sketches rather than facts, and lets his description take form to a large extent in dialect conversations. The effect is an entertaining though homely book, and one in which much of geographical interest is found between the lines. The illustrations are good, but a sketch-map would have been a welcome adjunct.

'South America To-day.' By Georges Clemenceau. (London: Fisher Unwin. 1911. Pp. 315. *Illustrations.* 12*s.* 6*d.*) This book is decidedly overweighted by its title, for the writer visited no more than Argentina, Uruguay, and Brazil, and saw little enough, at least, of the two latter countries. The name of a translator does not appear, but whether M. Clemenceau wrote in his own language or ours, his text preserves the characteristic French lightness of touch and power of description. Buenos Aires and Rio, Argentine wheatfields and cattle ranches, have obtained perhaps more than their fair share of word-picturing in current literature. But the ex-Prime Minister of France is an administrator, and his indications of administrative problems associated with the development of these South American lands will probably be new to most readers.

'De Buenos-Aires au Gran Chaco.' By J. Huret. (Paris: Charpentier. 1911. Pp. 529. 3*fr.* 50c.) This book combines mainly travel-narrative and economic study. On those towns and parts of the country which he closely studied the author writes exhaustively; thus he devotes nine chapters to Buenos Aires. In the course of his travels he saw almost every stage of development in various parts of the republic, and the comparisons and contrasts thus afforded are instructive. One long and interesting chapter is tersely headed "Liebig," and he deals fully with the traffic in meat as well as with that in cereals. It would appear that even now a section of opinion in the republic is not free of economic fears, but the writer views the future with confidence. At the close of the volume he quotes a highly suggestive instance of emigration from Australia to the Argentine.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Hann's Climatology.

'Handbuch der Klimatologie.' Von Dr. Julius Hann. Band III. Klimatographie. II. Teil. Klima der gemassigten Zonen und der Polarzonen. Mit 10 Abbildungen im Text. Dritte, wesentlich umgearbeitete und vermehrte Auflage. 9 × 7. Stuttgart: J. Engelhorns Nachf. 1911.

The bulk of this volume, which completes the latest edition of Dr. Hann's standard work on climatology, testifies to the great advance which of late years has been made in the establishment of systematic climatological observations. A work of such unique magnitude is, of course, beyond the reach of effective criticism. We might, however, suggest that climatic description according to the several political boundaries would have been in many ways useful and interesting. We should, for instance, have appreciated a section devoted entirely to the climatology of the British Isles; but we have to be content to find the British Isles dealt with merely in the broad geographical division of "North-Western Europe." In regard to the Polar Regions, Dr. Hann has, of course, availed himself of the results of the numerous recent polar expeditions, and produces the large amount of evidence available in support of the contention that the polar areas, especially the southern, are under high, or relatively high, atmospheric pressure. The existence of the south polar anticyclone is not yet, perhaps, beyond dispute. But theoretical considerations alone would have led us to suspect anti-cyclonic circulation at the poles. It would be difficult to conceive how otherwise the interchange of air-currents between the equatorial and polar regions could be effected, as it is and must be, though in an exceedingly complex manner. If the cold air leaves the polar areas towards warmer latitudes along the surface, the movement must be outwards from centres of high, or relatively higher, pressure, beyond the barometric minima situated in the colder portion of the temperate zones, of which the great low-pressure area between Scotland and Iceland is an example. To suppose that the polar air-currents returned equatorwards in the upper atmosphere would be, surely, contrary to the known laws of thermodynamics.

On p. 204 Dr. Hann points out the decided inferiority of the winter resorts on the south and west coasts of England to those along the Mediterranean, where the mean temperature of the air is similar—an inferiority due to the damp, stormy, and relatively sunless character of the weather in our northern resorts. We might point out in this connection that meteorologists sometimes err in their estimation of climate through paying too exclusive a regard to the mere temperature of the air—an important climatic element, it is true, but only

one among others equally important. One often hears, for instance, the winter climate of Britain unduly emphasized with respect to its "mildness." Warm for the latitude the British winter undoubtedly is, a circumstance which brings certain advantages. But "mildness" in this connection is a term of physiological signification, and in the general character of the weather the severity of a northern winter asserts itself, perhaps, more prominently in Britain than in many frost-bound continental countries, where the thermometer stands so much lower. In direct proportion as England and Scotland are warm in winter for their latitudes, so are they raw, damp, and gloomy, subject to violent gales, rapid fluctuations of temperature, and sudden visitations of severe frost and snow.

L. C. W. B.

Weather Forecasting.

'What will the Weather be?' By H. G. Busk. 2nd edit. *Photographs and Diagrams.* Cambridge: W. Heffer & Sons. 1911.

This little book consists essentially of a series of tables basing predictions of immediate forthcoming weather upon the direction of the wind in association with the condition of the barometer, according to the season of the year. Whilst we do not think it is possible to form generalizations of this description such as would hold, at the best estimate, on more than six or seven occasions in ten, we think that the book will serve a very useful purpose in causing those into whose hands it may fall to make a close comparative study of the predicted weather and that actually experienced, and so enabling them to build upon the principles already established. The forecasts actually set forth are not probably of greater value than one, for instance, which we have found by experience to hold fairly well for the south of England, namely, that a white or hoar frost usually portends rain, and a "black" frost snow. Apart, however, from the rather numerous exceptions which cannot be said to prove the rule, the prognostication is further vitiated by the occasional inability to decide whether a frost should be called white or black, inasmuch as a severe black frost, characterized perhaps by a hard sky and cutting easterly wind, will always be marked by a somewhat copious deposition of rime, which would in this case certainly foretell snow.

L. C. W. B.

POLITICAL AND COMMERCIAL GEOGRAPHY.

The Supply of Iron Ores.

'The Iron Ore Resources of the World.' An Inquiry made upon the Initiative of the Executive Committee of the XI. International Geological Congress, Stockholm, 1910. Vol. 1, lxxix. + 552 pp.; vol. 2, pp. 553 and 1068, 22 pls., 142 figs.; Atlas, 43 maps.

As iron is the most useful of all metals; there are periodic outbursts of anxiety as to the extent of the future supplies. The quantity of the richest iron ores is undoubtedly limited, and there is a steady fall in the grade of the ores used. The ingenuity of the miner and the metallurgist, however, continually renders poorer ore available, and the cheapening of transport continually increases the area from which it can be brought to the smelting works. Nevertheless there are frequent predictions of an iron famine. Hence the Swedish Committee which organized the last International Geological Congress in Stockholm, did a useful work when it collected a series of reports from all the iron-producing countries of the world containing estimates of the extent of the known iron ores. The reports have now been issued in two large quarto volumes and a folio atlas. They have been edited by Prof. Sjögren. He classifies the world

into four divisions according to the reliability of the estimates of its iron ores. Group A includes Europe and the eastern parts of the United States, the only large areas for which the calculations are fairly reliable. For the lands of Group B the estimates are very approximate. For C, including more than half the land of the world, no numerical estimates are possible; and for Group D, including a quarter of the land, the iron supplies are unknown.

Prof. Sjögren has made a rough estimate of the total available quantity of iron ores by multiplying the number of square miles of land of the Earth by the average amount of iron ore per square mile in Group A. According to this calculation, the supply of iron ore is 425 thousand million tons.

The origin of the ores is only considered in the monograph in so far as is necessary for estimation of the quantities. The most important contribution in these volumes is the evidence as to the actual and potential ore supplies of each of the chief iron-producing countries. The quantities are shown in a table compiled by Mr. Tegengren.

The various reports show that the supply of iron ores containing sixty or more per cent. of iron is limited. At the present rate of consumption the known supplies of high-grade ores will be exhausted in twenty years; the known quantities of the lower-grade ores, which are already being used in the iron industry, will last for another two hundred years, and by including the potential reserves the supply is sufficient for a thousand years. By the use of still lower-grade ores the supplies will last for thousands of years. Moreover, much of the iron which is produced will come into the market again as scrap iron, while the use of ferro-concrete is replacing iron for many purposes and thus lessening the demand. The development of many of the less settled countries will render available vast quantities of iron ores from South America, Australia, and Africa, and unless some of the lower-grade European ores are used at present they may be permanently wasted, as it may be impossible to work them in competition with the ores of countries which have not yet begun iron production. This authoritative monograph shows that there need be no anxiety as to the iron ore supplies of the world. The difficulty in the future of the iron industry is the possible failure of the supply of coking coal necessary for the reduction of the iron ores.

J. W. G.

GENERAL.

'Touring in 1600.' By E. S. Bates. (London: Constable. 1911. Pp. xiv., 418. *Illustrations.* 12*s.* 6*d. net.*) An acceptable work on a subject not hitherto too well investigated. The sub-title, "A study in the development of travel as a means of education," sufficiently explains the aim of the book. The period chosen is the hundred years centering in 1600, and the matter is presented synthetically, over two hundred and thirty travellers being mentioned whose narratives, both printed and manuscript, have been utilized. The result is a vivid picture of the state of Europe and the Mediterranean lands at this epoch, with the troublous adventures encountered by tourists. Although the work has entailed long research, its style is easy, and the result is a volume of very entertaining reading.

'The Life of Dr. Arthur Jackson of Manchuria.' By the Rev. A. J. Costine. (London: Hodder & Stoughton. 1911. Pp. 187. *Illustrations.* 2*s.*) This short volume is a proper tribute to the brief career of one whose missionary service was cut short by the plague in Mukden early last year. There are some admirable descriptive quotations from some of his letters.

'Behind the Ranges.' By F. G. Aflalo. (London: Secker. 1911. Pp. 284.

Illustrations. 10*s.* 6*d.*) Mr. Aflalo's stray reminiscences seldom fail to entertain, and his experiences range wide. The Mercator map, on which we learn his travels in search of angling are recorded, is evidently well covered.

'Exercises in Practical Geography: The British Isles.' By C. R. Dudley. (London: Philip. *N.d.* Pp. 69. *Maps.* 1*s.*) These exercises, which take the form of a series of questions, are accompanied by maps of good size and admirably clear. All are on the same scale for each country, and so can be readily compared. Teachers will find the questions suggestive, but will require to amplify them in some instances, as the inferences required for their answer are often decidedly difficult. Mr. J. A. White supplies some questions, accompanied by special maps, on London.

THE MONTHLY RECORD.

THE SOCIETY.

Sir Joseph Hooker.—At the meeting of the Society on January 15, the President (Lord Curzon) made the following remarks in connection with the death of Sir Joseph Hooker: I should like to say a word about the loss which geography and science in general have experienced since our last meeting, by the death of the veteran Sir Joseph Hooker. He was, as you know, in his ninety-fifth year when he died. He was elected a Fellow of this Society forty-five years ago. For many years he served as a Councillor and Vice-President, and I remember well, when first I had the honour of a seat on the Council, the keen interest displayed by Sir Joseph Hooker in our proceedings, which he made a point of attending with the greatest regularity. We have to go back as far as the thirties to find Sir Joseph Hooker beginning his career as an explorer and a botanist. He was on the staff of the famous Antarctic expedition under Sir James Ross. The results of that expedition, so far as Sir Joseph was concerned, were manifold and of the highest value. For it led to his systematic treatment of the botany of a large portion of the southern hemisphere. A good many years later Sir Joseph devoted himself for a considerable period to the exploration of the eastern Himalayas, which also resulted in a contribution of the highest value to geography and botany. Many of you have read his famous works which were the result of that expedition. Later still, he did admirable work in exploring the Moroccan section of the Atlas mountains. It was no doubt first of all as a botanist that Sir Joseph Hooker undertook these various expeditions, but he took a great interest in the geography of all the regions which he explored, and his botanical results deal largely with the question of geographical distribution. The advanced age to which he lived is in itself a proof of the wonderful vitality which he possessed, and those who knew him will bear me out when I say that he kept his youthful enthusiasms to the end. He may be said to be the last of that distinguished band which was intimately associated with

the great scientific revolution connected with the name of Charles Darwin.

The Building Fund.—At the meeting of the Society on January 15, the President made the following statement: As the Fellows of the Society are aware, we have been for some time past engaged in collecting money with a view to providing ourselves with premises, larger, more dignified, more convenient in every way than those which we at present enjoy. Our efforts still continue, and at the present stage I only desire to acquaint you with the fact that we have been fortunate enough to persuade His Majesty's Government to increase their grant to us, which at the present moment stands at £500, to the sum of £1250 a year. That is not only a munificent and very useful contribution in itself, but it is a testimony to the high place which our Society fills in the estimation of our own Government, and I hope I may add, in that of the civilized world. Later on in the course of the present year I shall place before you the results of the effort upon which we are engaged, which I think there is every reason to believe will culminate in success. (For report of special meeting, see p. 295.)

EUROPE.

History of the Cartography of Milan.—At the Geographical Congress held at Milan in 1901, an exhibition of plans and views of the city and surrounding territory was successfully organized by Signor Ettora Verga, and steps were afterwards taken to form a permanent collection of a similar character. A *catalogue raisonné* of this collection was brought out last year under the editorship of Signor Verga, who also supplies an introductory section on the history of the cartography of Milan. The earliest item is a diagrammatic sketch, of the kind in vogue at the time, contained in the chronicle of Galvano Fiamma, dating from the first half of the fourteenth century. The city is represented by concentric circles, and the chief attention is given to the various gates both of the inner and outer circuits of the city. Next come two plans, bearing the same general character, though independent of each other, which are found in two fifteenth-century manuscripts of Ptolemy's Cosmography. They make no attempt at exact topography, but merely represent the city as a circle, within which the positions of the main buildings and of certain water-courses are roughly indicated. Towards the end of the same century, and in the early part of the next, we come to the more or less fantastic representations to be found in such works as the 'Nuremberg Chronicle' of Schedel, and in Sebastian Münster's 'Cosmography.' The views in the former are for the most part purely imaginary, and many do duty for a number of different cities. This is the case with the view of Milan, although for the four chief Italian cities Schedel does seem to have been possessed of actual information. A step in advance was taken by the famous map publisher Antonio Lafreri, whose plan of Milan must be held, both from external and internal evidence, to have originally appeared about 1560, though the earliest known example is dated 1573.* It must almost certainly have been anterior to the very similar plan given in Braun & Hogenberg's 'Civitates Orbis Terrarum' of 1572. Both

* This plan is to be found in the copy of Lafreri's great atlas, presented to the Society by Lord Peckover.

represent Spanish Milan as it appeared after the alterations carried out under the governor Ferrante Gonzaga. While these plans found many copyists, this was not the case with the now very rare view by the painter Nunzio Galliti (1578), which occupies a position of its own. In 1603 a new advance is marked by the important manuscript plan of Francesco Richini, first published in facsimile in 1873, which differs from the perspective plans of the period in adopting the planimetric system, and in the unusual wealth of its information. As, however, it was never made generally accessible, its influence was less than would have otherwise been the case. The perspective plan of Marco Antonio Barateri (1629) had, on the contrary, a considerable vogue. In the eighteenth century examples naturally become more numerous, and include—besides various editions of that of Agnelli—a number of manuscript plans based on expert surveys, such as that of Filippini in 1722. But it is only with the opening of the nineteenth century that we find, in the plan of Pinchetti (1801), one which may be said to have been constructed on a truly scientific basis. A separate section of the memoir, which includes facsimiles of all the most important examples spoken of, is devoted to maps of the Milanese region.

ASIA.

Geographical Work of the Abor Expedition.—Important geographical results are to be expected from the Abor expedition on the north-east frontier of India, from which a survey party has been detached to explore the unknown part of the Tsang-po valley and reach the great falls reputed to exist near the Tibetan border.* An important subsidiary mission, in charge of Colonel Macintyre, was also sent to the Yam-ne valley, parallel to that of the Dihong, and this had completed its work and returned to headquarters early in January. Friendly relations were cultivated with the Panghi Abors, and the valley of the Yam-ne river was surveyed up to a point 12 miles north of its junction with the Dihong, while the valley of the Dihong itself was surveyed from a point 15 miles above Kebang to a point 35 miles above that place, and the course of the river sketched in for another 25 miles above that. A point worthy of note is that the Abors call the river we know as the Dihong the Tsiang, which is evidently their form of the name Tsang-po, meaning river of Tibet; a new proof of the identity of the two rivers being thus supplied. None of the Abors questioned had, however, heard of the reported great waterfall, but as they themselves had never been so far afield their evidence cannot be taken as conclusive. From above Param village in the Panghi Abor country, the Dihong could be seen to bend to the north of Ksat, about 35 miles north of Kebang, and then, after another 25 miles, to bend again northwards, bounded on the west by a fine snow range, out of which stood one magnificent peak resembling a sharp dog's tooth. The country visited by the mission contained a very populous village of about 2000 inhabitants, while all the lower slopes of the hills are cultivated, periodically at least, and in consequence are clear of the dense forest that ordinarily covers the summits of the ranges. On January 17 it was reported that the Dihong exploration party was camped near Rega, a great centre of slave dealing and raiding. Close to the village is a peak 1000 feet high, from which it was hoped that much useful survey work might be done, but progress was being much hindered by rain, clouds, and mist. The Gams of Rega, Sitang, and Parong were friendly,

* Reference to this supposed fall was made in vol. **38**, p. 202. The height has been variously estimated at 70 and 150 feet.

and had given the party much help. This was important as the attitude of the neighbouring villages had largely depended on that of Rega. It is mentioned that a mahseer weighing 55 lbs. had been caught in the Dihong. Later information, dated January 29, gives the progress of the various survey parties as follows. The main detachment on the Dihong had passed through Getti and Shimong, meeting at the former place two Tibetans; and on the 26th had reached Lugging (Puging ?). This place is 29 miles north of Shimong, so that the great westward bend of the Dihong above that place is incorrectly shown on the maps. The people were quite friendly, and the weather, an important factor, was then fine but cloudy. In order to explore the Yam-ne valley above the point previously reached, Colonel Macintyre had proceeded to Passi, a group of three villages at the south end of a large open valley. Here also the people were friendly, and the weather was fine but cloudy. A third exploration party under Captain Molesworth had crossed the Siyom on rafts on the 23rd, and left the following day for the Shimong. (The Siyom seems to be the stream marked Yekshing on some maps.) This party had reached Doksing and Parong. We understand that Captain Eric Bailey, who last year made an interesting journey across China, afterwards joining the Abor expedition, was hoping, when last heard of, to start on an exploring tour up the Dibong.

Dr. Legendre's Explorations in Western China, to which reference was made in the January number (p. 72), were continued during the summer of 1911, previous to the outbreak of the disturbances through which the lives of himself and his companions were for a time in some danger. A further letter from the traveller is printed in *La Géographie* for December, 1911. After completing the journeys already described, Dr. Legendre, with the help of MM. Dessirier and Noiret, set himself the task of exploring the little-known part of the basin of the Yalong, north of 28°. They began their work at Ta-lo-ho-pa, the point at which Captain Audemard had begun the descent of the river, and, separating for the purpose of covering as much ground as possible, traversed by their routes the greater part of the country up to 30° N., or the latitude of the western road from Ta-chien-lu to Tibet. During these journeys the singular bend of the Yalong, brought to light within recent years, which so closely reproduces the similar bend of the main Yang-tse on the same line of country, was mapped more precisely than it had previously been, while above this the stream was touched in as many parts of its course as the narrow and precipitous nature of its valley permitted. Between 28° and 29°, in an area of metamorphic rocks, the surface is exceedingly rugged, and the mountains are both high and steep, with no regular tracks. The main route through the country follows the valley of the She-pi-ho, a considerable tributary of the Yalong, which leads up to the important centre of Gho-ru (Ka Eul of the Chinese), whence routes run west and south-west to the Yalong at Me-te-rong and Bau-rong. The former is placed in the only considerable enlargement of the river-valley, which permits a good deal of cultivation. In spite of the altitude, a fairly high temperature is experienced, and two crops a year are reaped. The region is inhabited by various tribes of Sifans, the line of demarcation of which with the Tibetans is not well marked. The Chinese have lately been extending their influence in this direction. While M. Dessirier was surveying the Yalong to the north, Dr. Legendre made his way to Ta-chien-lu by Bonin's route; the loftier grassy plateaus which he had intended to explore being still (early in June) covered by thick snow. The granites of the region traversed in this direction display much gentler outlines than those of the country to the south. The variations of relief in the Yalong basin were much

greater than further east, and one of the ranges near Bau-rong was crossed at an elevation of 4700 metres (15,400 feet). Dr. Legendre found that his altitudes differed greatly from those recorded by previous travellers; but though he makes no claim to strict correctness, the behaviour of his aneroids, so far as tested by boiling-point observations and mercurial barometers, was such as to justify some confidence in the results. The Yalong had throughout the character of a rushing torrent, and its navigation, except for quite short distances, is impossible. Its general width was about 60 yards, and its depth is said to frequently reach 50 to 60 feet. Its annual rise is less marked than that of the Yangtse. The climate of its valley seemed similar to that of the Kien-chang valley to the east. An exceptional amount of rain fell in 1911 during the whole spring and summer, but as a rule the chief rain falls in summer, and high water occurs in July and August. Primeval forests of conifers and cupuliferæ clothe valleys and slopes up to 4000 metres and over.

The Murghab River.—In connection with a project of storing the water of the Murghab for summer irrigation, Mr. I. Kark made an examination of the river in 1908 (*Izvestiya* Russian Geogr. Soc., Nos. 8-10, 1910), his chief task being to find the source of the abundant silt which filled up an experimental reservoir constructed near Yolatan in 1895. Measurements taken at Tashkepri throughout the year show that the minimum discharge, in September, amounts to 838 cubic feet a second, the maximum, in March, to 3530 cubic feet, and the annual mean to 1385. The mean velocity of the current at different parts of the river is about 20 inches per second. The solid particles in the water are derived from the sand and clay of the loess in its bed, chiefly below Takhta-bazar. From the Afghan frontier the Murghab tends as far as Sultanbent towards the right bank; but below Sultanbent and Yolatan, where the deltaic fan begins, its deposits cause it to diverge westwards, and hence it is that the town of Merv has migrated westwards. The deposits of the valley of the Murghab are quite recent, being now in course of deposition. As to the hills that skirt the right bank of the river, and the left as far north as Kushk or beyond, it is not possible to determine their age exactly; but as they overlie much-inclined strata of undoubtedly Tertiary age, they cannot be earlier than the Oligocene period. Absence of stratification and fossils point to an æolian origin. Mr. Kark recommends the sinking of artesian wells, not simply as a source of water-supply, but also as a means of ascertaining the depth and age of the solid rock.

Ethnological Research in Kamchatka.—We are informed that Mr. W. Jochelson and his wife, members of the Kamchatka expedition organized by the Imperial Russian Geographical Society (*Journal*, vol. **33**, p. 719), with the support of the late Mr. F. Ryabushinski, lately reached Moscow on their return journey. Portions of the expedition had finished their work in 1909, and had already returned to Russia, but Mr. Jochelson continued his ethnographical explorations of Kamchatka and the Aleutian isles until the end of October last. M. Jochelson's work was very successful, and he brought home most valuable collections of stone-age implements, including household utensils of all kinds, stone knives, choppers, bows, etc., besides skulls and skeletons of the ancient inhabitants of the Aleutian isles and Kamchatka. Valuable results were also obtained in the domain of folklore; numbers of mythological texts and legends, both of the Aleuts and the inhabitants of Kamchatka, being collected. The languages of both peoples were studied, and dictionaries compiled. The social and economic condition of the natives was investigated, as also their physical type, and a large number of photographs, including

stereoscopic and cinematograph negatives, were secured. The anthropological and ethnographical collections of the expedition number three thousand specimens. Anthropometric records of three hundred natives were taken, and twenty-five plaster-masks were made. In accordance with the will of Mr. Ryabushinski all the collections will eventually remain at Moscow, though they will be exhibited temporarily at St. Petersburg.

A Forthcoming Work by Mr. Potanin.—We understand that the veteran explorer of Mongolia, G. N. Potanin, who usually resides at Tomsk, has lately visited Moscow. Notwithstanding his advanced age of seventy-five years, he is in excellent health, and is busily engaged on an important geographical work upon Mongolia and Central Asia.

AFRICA.

Major Darley's Journeys in the Upper Sobat Basin.—Reference was made in vol. **37**, p. 213, to exploring journeys carried out by Major Henry Darley, in 1908–09, on the headwaters of the Sobat, between Lake Rudolf and the Nile. We have now received some further notes (written at Mongalla, Sudan, in December of last year) on the geography of the same region, in which the traveller has continued his explorations since sending the earlier account. The headstream of the Pibor, which, as before stated, rises in Dodinga, is now said to bear the name Natilete. This flows through Toposa until it reaches the Kapowen swamp, formed by the combined waters of the Natilete and the Kuroni.* During the rains the water spreads over a tract about 40 miles long by 12 or 15 broad, which is then quite impassable.† But as soon as the rains cease the swamp begins to dry up, and in six weeks' time there is not a drop of water to be had in the whole country. It was under the latter conditions that the country was crossed by Dr. Donaldson Smith. The outlet of the swamp is 10 miles west of Kithiangor (Kathengwere of Major Gwynn's map, *Journal*, August, 1911), the water then flowing north-west to the Rotilla country (Bor). The tract waterless in the dry season extends from the Kuroni, some 20 miles south of Kithiangor, to Kenge, 30 to 35 miles north-west of the same place, where the water comes to the surface again in a series of springs. No other rivers from the Boma hills reach so far except during the rains. The whole country is mud, which seems to have been swept down in the course of ages from the Boma hills, silting up all the river-beds. The natives all fly to the hills during the rains. Kithiangor is a circular, crater-like hollow, formed in almost pure ironstone. Several old slave-fetters made from the iron were seen, but no information could be obtained as to their history. They are placed by the natives on high rocks and regarded as evil fetishes. The inhabitants of the district are known as Jiwe, and are very friendly to white men, being much raided by the Abyssinians. Many of the names on existing maps are said to be misleading, and much confusion arises from the different names given by different tribes to the same places. There seem to be two main groups of languages in this region, the components of each being closely interrelated. The Jiwe speak a Nilotic dialect, akin to the speech of the Toposa, Turkana, and Masai, while the other group, evidently

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* Kapowen is given in Donaldson Smith's map (*Journal*, December, 1900) as an uninhabited plain.

† This is evidently the flooded area reached from the north by Major Comyn (*Journal*, vol. **31**, p. 304), who, however, found it to be drained north-east to the Pibor, while Major Darley speaks of its outlet as flowing north-west.

Negro, is formed by the people of Mulile on the Akobo, those at Jebel Lafone, others east of Nimule, and the Kanifwa, near the Victoria Nyanza.

Arabic Geographical Terms.—We have received a typewritten copy of a useful compilation carried out in the Geographical Section of the Intelligence Department at Khartum, forming a glossary of Arabic geographical terms in use in the Sudan, transliterated according to the official system. The list is comprehensive, including, besides terms relating to strictly geographical features, such names as those of the principal trees and plants which form features in the landscape, or enter into the life of the people. Of the geographical terms, some—*e.g.* Khor, Darb, Gezira, Meshra, and others—are already well known, but there are many others the interpretation of which is welcome, not only in the interest of the general reader, but even of the professed geographer. Among such are: Khalla, an uninhabited forest or desert; Tamad, a water-hole; Gammam, a pool in the bed of a khor; Agaba, a steep pass, and also desert or uninhabited country; Ragaba, a khor in Southern Kordofan; Goz, a sandy hill or dune; and many others. The list has been printed in full in the *Journal* of the African Society (January, 1912), and thus made more widely accessible.

The Longitude of Bizerta.—The *Comptes Rendus* of the Paris Academy of Sciences for December 11, 1911, and January 22, 1912, give the results of determinations of the difference of longitude between Paris and Bizerta, made independently last year by MM. Lancelin and Tsatsopoulos of the Paris Observatory, and by MM. Noirel and Bellot, of the Service Géographique de l'Armée. The methods employed by the first two observers are described by M. Renan, who states that particular care was taken to obviate the usual sources of error in longitude determination by exchange of telegraphic signals. The personal equation in the determination of the local time by passages of stars was in great measure eliminated by an ingenious automatic device, while the employment of the Hertzian waves of radio-telegraphy for the exchange of signals permitted the observers to dispense with the chronograph. The waves were emitted at regular intervals both at the Eiffel Tower and at the Arsenal at Bizerta, and were received by each observer at his own station by a telephone, which also transmitted the beats of his own pendulum for comparison. Two series of observations were made, the observers exchanging stations in the interval, and the accordance of the two results showed that there was no trace of a personal equation. The value worked out as 29 min. 52·40 sec. ± 0·01 sec., *i.e.* in arc, 7° 28′ 6″ east of Paris, or 9° 48′ 20″ east of Greenwich. The operations of the second pair of observers are described by Colonel Bourgeois. Local time was in this case determined by the new prismatic astrolabe (cf. *Journal*, vol. **38**, p. 182), and the results supply an interesting comparison of the accuracy obtainable by this instrument and by the most modern instruments used in astronomical work. The same pendulums were used at both stations as by the previous observers, and the same method of exchanging signals by radio-telegraphy was used. The value obtained in this case, when referred to the same points as in the former, was 29 min. 52·385 sec. ± 0·01 sec.—a difference of only 0·015 sec. The time taken by the waves to cover the distance between the two stations was only 0·005 sec., giving a velocity practically equal to that of light.

African Trans-continental Railway Projects.—The past year has been marked by a recrudescence of activity in the direction of projects for the further development of railway communication in Africa, some of the schemes being of a particularly grandiose character. M. André Berthelot is chiefly responsible

for a revival of the old Trans-Saharan scheme in an extended form, and his views are explained in the January number of *L'Afrique Française*, on the basis of an article in the *Matin* of October 26 last. Recognizing that the resources of the Sahara can never be sufficient in themselves to support such a railway, M. Berthelot looks to the regions beyond—far beyond the limits of the French possessions, in fact—to supply the future traffic. His scheme, therefore, provides for the building of a line from Algeria south-east to Lake Chad, and on by the Shari basin and the Nile-Congo water-parting to Uganda, where it would join hands with the British system, and so supply a through route from Algeria to Mombasa; while, on the completion of the Cape to Cairo trunk line, it would also communicate with the rich mineral district of Katanga, and even with the Cape. A branch line from the Saharan section south-west to the middle Niger is regarded as an important adjunct to the scheme. M. Berthelot's proposal has met with a good deal of support, and an expedition under the well-known explorers Niéger and Cortier, assisted by a number of experts, has already left France for the study of the ground to be traversed by the proposed line. A second trans-continental scheme, which has been a good deal spoken of of late, is that for a junction of the German East African Railway (now completed nearly to Tabora) with the proposed Belgian line across the Southern Congo basin to Tanganyika (cf. *Journal*, vol. **37**, p. 318), thus giving a trunk line across from Matadi to Dar-es-Salam, with merely a break at Lake Tanganyika. Early last year, as described in the *Mouvement Géographique* for January 14 last, negotiations were set on foot in reference to a projected Franco-German railway from the Kamerun to the Ubangi, a scheme which had been already mooted two or three years before, but without result. While intended primarily to afford access to the interior of the Kamerun and the French territory on the Ubangi, the line would, if extended across the Belgian Congo to Lake Tanganyika, have supplied another trans-continental connection, and formed a link between the German territories on the east and west. The negotiations were abortive, as it was felt on the French side that the line would favour the development of the Kamerun at the expense of the French Equatorial Africa. The idea of a future line, or lines, from the coast to the Ubangi was kept in view in the Franco-German treaty of November 4, 1911 (*Journal*, vol. **38**, p. 622, and *ante*, p. 75), and an agitation has been set on foot in France in favour of the prompt construction of a line across the basin of the Ogowe, as a means of counteracting the loss to French Equatorial Africa through the recent treaty (see *L'Afrique Française*, January). It may be greatly doubted whether the benefits to be derived from such lines would come up to the expectations of the promoters, and some judicious remarks of M. Wauters, in the *Mouvement Géographique* of November 5 last, are much to the point in this connection. In the case of Africa, no such shortening of distance would be effected by such trans-continental lines as by those across North America or Northern Asia, while under existing conditions it is not to be expected that land transport would compete with any decided success, as regards speed, with modern steam navigation.

Other African Railways.—The much-needed railway connection between the Shire Highlands and the sea seems at last in a way to be secured by the conditional promise of Government support. Application has been made to the Portuguese Government for permission for the line to pass through Portuguese territory, and the carrying out of the scheme will be dependent on the construction of a line from the Zambezi to Beira through the Mozambique Company's territory, for which arrangements are also being made. The extension of the

British Uganda railway from Ripon falls, down the valley of the Victoria Nile to Kakindu, has also made some progress, and a section was opened for goods traffic on January 1 of this year. The oldest railway of the German colonies, that of Usambara, of which the first section of 40 kilometres (25 miles) was opened to traffic so far back as 1896, at last reached its provisional terminus at Moshi, at the southern foot of Kilimanjaro, in October, 1911. A sketch of the history of the project, with description of the route, illustrated by a map and sections, appeared in the *Deutsches Kolonialblatt* for November 15 last. In German South-West Africa an important new railway connection is that from Windhuk to Keetmanshoop, which links together the northern and southern systems in a direction parallel to the coast; thus supplying, in conjunction with existing lines, a north-to-south communication over three-fourths of the whole length of the territory (*Deutsches Kolonialblatt*, January 1, 1912, with map).

AMERICA.

The Hudson Bay Route to Central Canada.—According to a telegram from Toronto on February 14, energetic steps are to be taken by the Canadian Government to push forward the scheme for the opening of the Hudson bay route from this country to the centre and west of Canada. A detachment of engineers is to be sent at once to report on the best harbour on the bay to serve as the port of call for a line of steamers from Europe and also the terminal point of the proposed railway from Le Pas; the choice in the latter regard lying between Port Nelson and Fort Churchill. The experienced Arctic navigators, Captains Anderson and Bartlett, will also make a voyage to Hudson strait and bay in the early spring, for the purpose of examining their possibilities for navigation.

The Trinidad Mud-volcano.—We have received the following notes on the recent eruption off the coast of Trinidad (January number, p. 76) from Mr. W. H. Whiteman, together with a series of photographs, of which we reproduce three. It seems that the new island was first noticed by a boatman on the afternoon of November 3. On the 4th a sergeant of police went with others in a boat for the purpose of erecting a warning beacon on the island, which was reached at 5.25 p.m. Alarmed by the rumbling noise and the bubbling of the sea in the vicinity, the party fortunately decided to return, only just escaping the explosion. The column of fire which followed this is supposed to have lasted about ten minutes. It was seen as far as Port of Spain, 50 miles off. The Governor's party, whose visit was referred to in our previous note, was prepared to take possession by the hoisting of a Union Jack, but as the island was found to be well within the 3-mile limit, this was unnecessary. An American geologist who visited the island on November 9 found the mud hard and honeycombed except near the water's edge, but four craters were still active. The size of the island was then about 3 acres, and its greatest height 12½ feet. On the 10th, Captain Hannam, of the R.M.S. *Kennet*, found the crater still active, and emitting a sound like that of some huge humming-top. Mud was being ejected from fissures to a height of 15 feet, and the earth in the vicinity was very warm. Mr. Whiteman visited the island on December 23, and found all the craters silent. Birds were seen, and will no doubt be the means of conveying seeds of plants from the mainland. The top, as shown in the third photograph, is very rough and honeycombed. At the northern end there are quantities of small stones, the upheaval having apparently occurred at the extremity of Despatch reef, a rocky point running out from the coast. The size was still about the same as at the time of Captain Hannam's visit (600 by 450 feet), but the height had

VIEW OF THE MUD ISLAND, TRINIDAD, FROM BOAT.

VIEW SHOWING THE GROWING BEACH.

CRATER ON THE NORTHERN END.

increased to about 18 feet (possibly owing to the state of the tide). A beach, reaching 50 feet in width in the north and west, had formed right round the island, indicating that the island was still growing. This beach will keep the sea from breaking against the soft mud, and may save the island from destruction unless a further explosion takes place. All the observers noticed iron pyrites among the stones mingled with the mud. The island appears to lie on the crest of the southern anticline of Trinidad, and therefore along the line of the oil-bearing beds of the island. Mr. Robert Anderson of the United States Geological Survey, who spent some time in Trinidad shortly before the event, calls attention (*Science*, December 15, 1911) to the absence of true volcanic phenomena on the island, and points out that the eruption was due to the sudden escape of a large quantity of gas from the submerged strata. During his stay he had visited numerous gas volcanoes in southern Trinidad, where eruptions of this type are constantly going on on a small scale, while large outbreaks occasionally occur. All are due to the escape of gas from the sandy and clayey strata which imprison it. The remarkable point about the recent eruption was the fact that the gas ignited—a very rare occurrence, which may possibly have been due either to sparks caused by the friction of boulders, or to electric sparks similar to those observed during the Pelée eruption.

AUSTRALASIA AND PACIFIC ISLANDS.

The Proposed Trunk Railway between West and South Australia.—An official report on this projected railway, by the consulting engineer, Mr. H. Deane, was issued last year at Melbourne. It traces the history of the project, the steps taken to decide on the most suitable route, the probable cost and future returns on the outlay, besides discussing technical points concerning the methods of construction. A survey of the route was carried out in 1908–9, and the final proposals are as follows: The line will begin at Kalgoorlie, the gold-mining centre in Western Australia, and will run first south-east, and then generally east near the 31st parallel of south latitude, until it reaches the South Australian border in lat. 30° 45′ S. It will then cross the Nullabor plain, still in a generally east direction, and, after traversing a belt of sandhills, will make for Tarcoola, near which gold-mining is being carried on with some success. From Tarcoola to Port Augusta, near the head of Spencer gulf, the line surveyed runs through occupied pastoral country, gradually bending more to the south, and passing through the lake country west of Lake Torrens. Some deviations from this route have been suggested, but the above line seems the most generally advantageous. At its nearest to the head of the great Australian bight, the distance from the coast is about 60 miles, and as the intervening tract is of an inhospitable nature, there seems little danger of attack by a possible enemy. The total length is just over 1063 miles, of which about 462 are in Western, the rest in South Australia. After leaving the auriferous greenstone belt of Kalgoorlie, the route traverses a granite area for about 100 miles, and then a wide belt of limestone extending to the sandhill country. East of this granite occurs again, followed near Tarcoola by the gold-bearing quartzites. The soil is for the most part good, and though the deficient rainfall (7 to 8 inches yearly) is a drawback, its suitability for permanent occupation is undoubted, wherever a supply can be obtained by boring or storage. On the Nullabor plain boring has been carried out with success, but over a large part of the route nothing has been done in this direction, while north of Tarcoola a bore has been put down 3000 feet without reaching water. The estimated cost is about £4,000,000, and the view has been expressed that though a loss at

first is unavoidable, in ten years a surplus could be anticipated. It is pointed out that the rapid development of Western Australia since that state first put in a claim for railway connection with the east renders the execution of the scheme still more desirable now. The journey from Melbourne to Perth will be reduced from nearly 5 to practically $2\frac{1}{2}$ days, and a considerable passenger traffic is likely to spring up, while the probable goods traffic will include carriage of wool, live stock, or carcases, and machinery for mining and agriculture.

Mr. Wollaston's Proposed Expedition to Western New Guinea.—Mr. A. F. R. Wollaston, who took part in the British Museum Expedition to Ruwenzori in 1906, and also in the recent expedition of the British Ornithologists' Union to Western New Guinea, is planning to return to the latter region in the autumn of the present year, having already secured the permission of the Dutch Government, and the promise that every possible assistance will be rendered by the local authorities. The principal object of the new expedition will be the exploration of the Snowy range (the Nassau range of the Dutch) which was approached, but not reached, by the recent British expedition, as well as by the Dutch expedition to the Utakwa river in 1910. An attempt will be made to reach the watershed, and, if possible, to climb Mount Carstensz, the highest point in the range (15,964 feet). The leader will be accompanied by Mr. C. Boden Kloss, who has travelled much in the Malay countries, and is now curator of the museum at Kuala Lumpor; and possibly by a geologist. He will take a body of trained Dayaks, who will help with the collections. Mr. Wollaston hopes to leave this country in May, in order to recruit Dayaks in Borneo, and to land in New Guinea in September, so as to take advantage of the comparatively dry months of November and December. He will probably chose the Utakwa river as the line of approach to the mountains.

The Matavanu Volcano, Samoa Islands.—Communications from observers in Savaii, printed by Prof. Sapper in the last number of the *Zeitschrift* of the Berlin Geographical Society for 1911, show that the volcano of Savaii, whose eruptions have attracted so much attention during the past few years (see Dr. Tempest Anderson's description in the February number, p. 129), has now become almost entirely quiescent. Writing in August last, Dr. Grevel reported that the nightly glow had ceased, and that a visitor to the crater had found a firm crust in the position of the lake of lava. In October Pater Mennel, whose observations on the volcano throughout its period of activity have been of great value, confirmed the reports, and described a visit he had paid early in the month. Some slight emission of steam then continued to be made, but the characteristic feature was the constant succession of avalanches of cinders and volcanic sand, unaccompanied by steam. In spite of its solid appearance externally, a large part of the mountain was still in a dangerous state of instability. A descent was made almost to the crater-floor, which was almost concealed by masses of fallen *débris*. A number of white stalactites slightly tinged with sulphur were collected.

POLAR REGIONS.

The New American Arctic Expedition.—We alluded last year (vol. 38, p. 78) to the expedition to Crocker land—supposed to have been seen by Peary in 1906—which was being organized by Prof. D. B. MacMillan and Mr. George Borup. Further particulars as to the explorers' plans have lately reached this country. It is now estimated that the total cost will be $50,000, or about

£10,000, of which $6000 is contributed by the American Museum of Natural History, which undertakes the general management, and a like sum by the American Geographical Society. It is hoped to leave Sydney by special steamer in July next, collecting dogs and whale and walrus meat on the way. Winter quarters will be established on the south side of Bache peninsula, and from September onwards supplies will be taken by sledge to Cape Thomas Hubbard, whence, in February, 1913, the party will start over the ice for Crocker land, remaining there till May.* After sending news to North Star bay, the explorers will do scientific work in Grant land and along the return route to the winter quarters. During the summer of 1913 supplies and collections will be transferred to Etah, and in the spring and summer of 1914 an expedition will be made from Whale sound eastward to the summit of the Greenland ice-cap at the widest point of that island. Finally, the party will return by special ship in the autumn of 1914.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The "Carnegie" Magnetic Research in the Indian Ocean.—As already mentioned in the *Journal* (vol. 36, p. 736), the *Carnegie* set out in June, 1910, for an extended voyage for magnetic research through the three great oceans. The results obtained last year in the Indian ocean during passages from Cape Town to Colombo and from Colombo to Mauritius, sent by Prof. Bauer and Mr. W. J. Peters from Mauritius in August last, are recorded in *Terrestrial Magnetism* (vol. 16, No. 3, 1911). They show that the values given in the most recent charts contain exceptionally large errors, reaching in the case of the declination values to as much as 4° and in one of the charts even to 6°. The tables given show the errors of the British, German, and U.S. charts for each of the positions where determinations were made by the *Carnegie*. Except quite at the beginning, the westerly declination of the charts is always too small, the errors being in the main due to an incorrect estimate of secular changes, as applied to the previous data on which the charts depend.† An estimate is made of the values of secular change as deduced from a comparison of the *Carnegie* results with those of the *Gauss* in 1903, at points common to the tracks of the two vessels. This shows that while westerly declination is at present increasing in two portions of the Indian ocean, to the extent, respectively, of 13′·2 and 5′·4 yearly, in another area it is diminishing by 10′·9 yearly. These large changes and their rapid variation with geographical position are remarkable; the British and United States chart values lying entirely between +2′·6 and −2′·8.

GENERAL.

A System of Wireless Telegraphy for the French Colonies.— The French paper, *L'Illustration*, in its number for January 13 of this year, gives some interesting facts as to the communications by wireless telegraphy already brought into use between France and some of her colonies, with an outline of a suggested scheme, due originally to M. Messimy, for linking together the whole French colonial empire by this means. The Eiffel tower is already in communication with a number of places in Morocco, Algeria, and

* Bache peninsula runs out from Ellesmere island into Kane basin, and is bounded on the south by Flagler bay. Cape Thomas Hubbard is the northernmost point of Axel Heiberg island, reached by Peary during his western journey in 1906.

† The negative error in the British charts varies from −0·2 to −3·7; in the German from −0·6 to −6·2; in the U.S. from −0·1 to 2·5.

Tunis, and might be connected in future with Rufisque (Senegal), Timbuktu (where a station is already in construction), Kotonu (Dahome), and with Bangi on the Ubangi river; these also communicating mutually and with a number of secondary stations. Bangi, from its central position, would be a particularly important focus, and would permit the chain to be extended south to Loango and Brazzaville, east to Jibuti, and south-east to Madagascar. Jibuti in turn would carry on the succession to Pondicheri and Saigon, and so to the Pacific islands, Martinique, and Rufisque, where the circuit of the globe would be completed. Tananarivo in Madagascar, and Saigon, would be important local distributing centres, and Martinique would send a branch to French Guiana, all the colonies being thus provided for. The proposed network is shown on two sketch-maps, one embracing the whole system, the other the Franco-African connections. The project has not yet advanced far towards realization, the necessary funds being not yet forthcoming.

Oxford School of Geography.—The annual report of the school for 1911 contains the following items of more general interest: Mr. D. W. Freshfield has been nominated as a representative of this Society on the Committee, in place of Sir Clements Markham. This is especially appropriate, for Mr. Freshfield has always taken the greatest interest in promoting the study of geography in his *Alma Mater*, both as a member of Council of the R.G.S. and by his liberal contribution towards the endowment of Geography in the University. The generosity of Sir Abe Bailey has allowed the collections of the school to be transferred to Acland House, which he has furnished at a cost of £500, besides guaranteeing the rent and upkeep for five years. In addition to seminar and tutorial rooms, a library and two reading rooms, one for Colonial Geography and History, were ready at the beginning of 1911. It has since been found necessary to enlarge the accommodation both for readers and for books. In addition to the geographical library, the Anthropological and Geographical books in the library of Emeritus Professor Sir Edward B. Tylor, which have been generously lent to the University, are kept in the school. The number of students devoting most of their time to geography in 1910–11 was 44 (22 men and 22 women). One of these students was doing research work, 5 were preparing for the I. C. S., 25 for the Diploma, 7 for the Certificate, and 6 were doing other work. The Committee also made arrangements which permitted a member of the Colonial Service at home on furlough to take his special course in surveying, etc., in Oxford. In addition, a considerable number of students came to courses of lectures. A number of lecturers are thanked for delivering special lectures—Dr. J. Douglas, Dr. T. Longstaff, Captain H. G. Lyons, and Dr. F. Nansen. Two of the district monographs prepared by students of the school and a paper on Thermal Regions by Prof. Herbertson are in the Press, and will be published under the general title of 'Oxford Studies in Geography.' In 1911 the Diploma was awarded to 8 students, 4 of whom obtained distinction, and Certificates were given to 15 students, 3 of whom obtained distinction. The school now possesses nearly 4200 books, pamphlets, and atlases, and over 10,000 sheets of maps, 445 wall maps, and over 2000 lantern slides. The wall maps are lent to professors and lecturers in the University, and 286 were so borrowed in 1911.

The Geographical Association.—The annual report for 1911 states that the number of members is now 692, an increase of 60 during the year. Two new branches of the Association have been formed, one at Leeds and one at Chester. The work of the branches is being carried on mainly by lectures and excursions, which are detailed at the end of the report. The policy of charging

nothing for the outward carriage of books from the Lending Library has been very successful, and the Committee have decided to vote more money to the library. Attention is called to the statement of the work carried on in the geographical departments of British Universities, made in the autumn number of the *Geographical Teacher*, in which the more important papers read to the Association or its branches are published. Reference is made to the valuable assistance given by the Gilchrist Trustees in founding the Geographical studentship mentioned in the February number of the *Journal*, p. 164, and also to the great loss the Association has sustained in the death of Dr. R. Davies Roberts, who was for many years a member of its Committee. One of the most important activities of the Association is the answering of letters from members about books, maps, apparatus, etc., and it is stated that this work has increased considerably. The brunt of it falls on Mr. J. F. Unstead, Hon. Correspondence Secretary, but the Hon. Secretary and other members of the Committee also take part in the work.

The International Congress of Prehistoric Anthropology and Archæology will hold its fourteenth session at Geneva during the first week of September of this year, under the Presidency of Dr. Eugène Pittard. Besides the papers and discussions, the programme includes a tour of the Lake of Geneva by special steamer; visits to the National Museum at Zürich, and to the Lake of Neuchâtel, where it is proposed to excavate the site of a lake village; and other excursions. The Secretary is Dr. Waldemar Deonna, 16 Bd. des Tranchées, Geneva.

Catalogue of Geographical Documents.—The annual catalogue of geographical books and other documents, issued by F. Muller & Co. of Amsterdam, contains this year an unusual number of interesting rarities in the form of early atlases and narratives of voyages. Besides Ptolemys, and atlases by Mercator, Ortelius, Blaeu, and others, we notice copies of the first edition of Waghenaer's 'Speculum Nauticum'; of the rare 'Atlas Minor' of the Brothers Allard (about 1705), with the large view of New York on the map of New Netherlands; various early works on navigation, including the French edition of Medina's 'Arte de Navegar' (1554); voyages published by Cornelius Claeszoon of Amsterdam, including the Dutch version by Van Meteren of Candish's circumnavigation; the English edition of Linschoten (1598), rarely found complete with all the maps; besides many items dealing with America, Africa, and Asia. As is to be supposed, the prices of such rarities shows no tendency to diminish.

OBITUARY.

Lord Stanmore.

On January 30 there passed away, in his eighty-third year, Arthur Hamilton Gordon, G.C.M.G., the first Lord Stanmore. The son of a Prime Minister, the Earl of Aberdeen, and the half-brother of the Duke of Abercorn, he was related to many of the highest in the land, and, after leaving Cambridge, his position as his father's private secretary brought him into contact with the most eminent.

With such surroundings it was natural that he should look forward to public life and administrative employment. Had he lived in the Middle Ages he would probably have been an ecclesiastic, and possibly a great ecclesiastical statesman. In our modern conditions he tried Parliament, which was not a

success, and then, on the advice of his friend, Sir George Grey, he obtained a Colonial Governorship, and successively ruled New Brunswick, Trinidad, Mauritius, Fiji, New Zealand, and Ceylon, and was the first High Commissioner of the Western Pacific. A Crown Colony was best suited to his temperament, and the Colonial Office, recognizing a strong man, sent him where the work was uphill and popularity not to be looked for; not that popularity would easily have come to him, for deep religious conviction, a somewhat austere manner, and a very high sense of the dignity of his office are not always popular attributes. However, his austere manner disappeared as his years advanced, and the sense of the dignity of his office, which was the occasion of certain stories more amusing than true, never interfered with the roughest life where work was to be done, and the Governor of Fiji was more often to be seen tramping his roadless domain for days on end clad in a flannel shirt and trousers rolled up to his knees than in a more conventional garb. The cry sometimes raised that he was too much the native's man was sure to arise against one whose powerful imagination and strong historic sense enabled him to grasp the native point of view, whether he were dealing with the barbarism of the Western Pacific or the ancient civilization of the East, and was merely the result of his determination to rule with an even hand. Once he was offered the position of Podestá to a great Spanish American State torn by party conflicts, and the offer presented many attractions to him, but fortunately the temptation was resisted.

His friendship with Mr. Gladstone dated from the time that statesman was a member of his father's cabinet, and became more intimate when he accompanied Mr. Gladstone to the Ionian Islands as his private secretary. At the conclusion of his long career as Colonial Governor, Sir Arthur Gordon was raised to the peerage as Baron Stanmore; he found the atmosphere of the House of Lords congenial. Lord Stanmore was for some years a member of the Council of the Society, but cannot be claimed as a geographer beyond the limit of having seen much of the Earth's surface, and of taking great interest in the maps and topography of the colonies he governed. The attraction of his strong personality was shown in the regard and sincere attachment of his personal staff, some of whom now fill high administrative posts in the Empire. Lord Stanmore maintained his keen interest in public affairs until the very end of his long, hard-working, and honourable life.

A. P. M.

Admiral Sir J. C. Dalrymple-Hay.

The Society has lost one of its oldest members in the person of Admiral Sir John Dalrymple-Hay, who joined its ranks in 1852, or just sixty years ago. Having been born on February 11, 1821, he had almost completed his ninety-first year, and was thus but little younger than the other veteran lately lost to the Society, Sir Joseph Hooker.

The son of Sir James Dalrymple-Hay, second baronet, the late admiral entered the navy in 1834, and saw service on various foreign stations, being present, in the *Benbow*, at the capture of Acre in 1840. Becoming lieutenant in 1844, he served in China under Sir Thomas Cochrane, and was promoted to the command of a ship in 1846. His most brilliant exploit was the complete defeat, in 1849, of Sha-ping-tzai—a redoubtable pirate with sixty-four junks under his orders—in the Tongking river, then almost uncharted and little visited by European vessels. During the action and subsequent pursuit almost

the whole piratical fleet was destroyed. Promoted to the rank of captain in 1850, Hay commanded various ships, ending on the North American station as captain of the *Indus*, the last sailing line-of-battle ship commissioned for service at sea. Succeeding to the baronetcy in 1861, Hay entered Parliament in 1862, and sat in the House of Commons with little intermission until his final retirement from public life in 1885. He became a Sea-Lord of the Admiralty in 1866, in which year he had been promoted to the rank of rear-admiral. He was retired compulsorily under Mr. Childers' scheme in 1870, at the age of not quite forty-nine years. In 1847 he had married the Hon. Eliza Napier, third daughter of the ninth Lord Napier, by whom he had three sons and six daughters.

Among other works, he was the author of 'Ashanti and the Gold Coast' (1873), and 'Lines from my Log-books' (1898).

CORRESPONDENCE.

Unstead and Taylor's 'Commercial Geography.'

We would beg space to controvert what must be regarded as ill-founded criticism in the review of our book on 'Commercial Geography' in the February number of the *Geographical Journal*.

In the first place, although we acknowledge one slip the reviewer has pointed out, we must maintain the accuracy of all the other statements to which exception has been taken. The reviewer states that in connection with Egyptian cotton the reader is led to infer that Egypt has an appreciable winter rainfall; this he denounces as "absurd." Now the chief cotton-growing areas are found in the Nile delta, and a twenty-seven years' rainfall record for Alexandria gives the average rainfall *per month* during the four winter months, November to February, as 1·85 inches (Hann). That this is appreciable is shown by a comparison with London, where the average rainfall per month during the same period is just 2 inches, and we therefore fail to see the absurdity of pointing out to the reader that this rainfall is not made use of by the cotton crop.

Again, the reviewer objects to our statement that (undeveloped) coal deposits are widely distributed in the Balkan Peninsula. He says this "is not true even of lignite, still less even of decent Tertiary lignite." Against this dictum we would cite the following authorities: Chisholm's 'Handbook of Commercial Geography' mentions two coalfields in Servia, and the mining of brown coal in Bosnia, to which is to be added from the 'Précis de Géographie Économique,' by MM. Dubois and Kergomard (1909 edition), the following list of nine places at or near which coal (not lignite) deposits exist: Pernik, Trevna, Elena, Kotel, Aïtos, Plevna, Lovetz, Vratsa, and Dobra. In regard to Turkey, the same work states, "On a relevé des gisements assez considérables de lignite," and in the 'Statesman's Year Book' the annual production of lignite in Greece is given.

Further, if we are wrong in including lemons among the fruits of the extreme south of the United States, the delusion is shared by American authorities. In the 'Commercial Geography,' written by Mr. Gannett, the official geographer of the United States, in collaboration with Mr. Garrison and Dr. Houston, it is stated that "oranges, lemons, and pineapples are raised in Florida"; Prof. Spencer Trotter, in his 'Geography of Commerce,' says,

"Florida produces lemons, pineapples, and other tropical fruits," and in their book on North America, Prof. Tarr and Dr. McMurry say of Florida: "There are orange and lemon groves in many parts of the State."

Still once more, objection is taken to our statement that the water-power of New England enables cotton goods to be manufactured cheaply; we submit that here the emphasis is rightly laid on water-power as the natural basis of the New England industry, even now that it is largely supplemented by steam-power. The combination of coal, iron, and water, with the proximity of the raw material in the southern manufacturing region, is in striking contrast with the northern conditions, hence in regard to the north we emphasize the water-power as the one natural resource. In the reviewer's sentence, "New England has gone so much beyond her water-power (and so must rely upon coal), that by 1907 North Carolina had 276 cotton mills against 204 in Massachusetts," the second part does not follow at all from the first; it only suggests that our book lays stress merely upon the northern industry, whereas, as a matter of fact, we give more space to the southern industry.

In addition to raising such questions of accuracy, the reviewer demands that more detailed information should be given, *e.g.* in regard to the coal deposits of China; he quotes us as saying that coal exists in every province of China Proper, and adds: "a statement which no examiner would accept in place of some specific reference to the Kaiping basin or Shansi anthracite, etc." As practical teachers and examiners, we hold that it would be out of place either to give or to demand such detailed knowledge in connection with elementary pupils using a small text-book of less than 250 pages. But, moreover, the reviewer's quotation is incomplete; we state also that the amount of the coal deposits in China is probably greater than in any other country, not excepting the United States, and that the greater deposits lie mainly in the interior, and as yet are but little worked. In this, as in the other cases, we think that a sense of relative importance and of the limits of the pupils' time justifies our treatment.

It is not, however, on such questions of opinion that we mainly object to the reviewer's comments; the serious matter lies in his mis-statements and denial of the facts for which we have above given our authorities.

J. F. Unstead,
E. G. R. Taylor.

The Tsetse Fly and Big Game.

Tempe, O.F.S., 26.1.1912.

In the *Journal* for January, I see that Sir Alfred Sharpe expresses his opinion that the tsetse in British Central Africa does not depend on big game for its existence.

I should like to point out that in Kordofan I came to a similar conclusion. The Kowalib hills swarm with tsetse, though the natives killed off all the game in or near the fly-belt before we reoccupied the province.

W. Lloyd, Captain,
The Cameronians.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1911-1912.

Special General Meeting, January 15, 1912.

The PRESIDENT (Earl CURZON OF KEDLESTON): This meeting of the Fellows of the Royal Geographical Society has been summoned under the terms of the Charter, which I will read: "And we further will, grant and declare, that the whole property of the said body politic and corporate shall be vested, and we do hereby vest the same solely and absolutely in the Fellows thereof, and that they shall have full power and authority to sell, alienate, charge, and otherwise dispose of the same as they shall think proper; but that no sale, mortgage, incumbrance, or other disposition of any messuages, lands, tenements or hereditaments belonging to the said body politic shall be made, without the approbation," and these are the significant words, "and concurrence of a General Meeting."

It is because of these terms that we have summoned this General Meeting this afternoon in order to ask your sanction to offer for sale the existing property of the Society. Gentlemen, this move has been very long in contemplation. Fond as I think most of us probably are of our old premises in Savile Row, where I myself have spent many happy hours in the past, I think we all realize that our quarters there are inadequate for the purposes for which we as a Society exist, and to a large extent unworthy of the premier Geographical Society of the world. There is not sufficient space for our ever-expanding collection of books and maps. The rooms allotted to purposes of instruction, to the map draughtsmen, and to the clerical staff are cramped and inadequate. We ought to provide better accommodation and rather more reasonable amenities for those of our Fellows who come to our premises; and above all in our present quarters we have little or no scope for the expansion that I should like to see lie before the Society in the future. These opinions have been held by the majority of those who are familiar with the Society for the last twenty years. When I was first a member of Council, I remember being appointed on a committee with Dr. Keltie to search for better premises. I deeply regret that we were not successful, or that our advice, if it was given, was not taken, because we might have obtained premises in those days for a price which would make your mouth absolutely water now. However, we are face to face with the situation as it now exists. During the last twenty years the need for a move has been constantly put before you by your successive Presidents, and by none more emphatically than by Sir Clements Markham, who year after year, in his Presidential addresses, drew attention to the subject. My immediate predecessor, Major Darwin, was the first to take practical steps in the way of raising funds, because at a general meeting in May, 1909, he proposed a Resolution which I will presently read, and he started a Building fund which has provided the nucleus of our efforts on the present occasion. The Resolution which you passed in May, 1909, was this: "That in the opinion of this meeting it is desirable to build or purchase a house or site elsewhere, or to rebuild, enlarge, or remodel the existing house; that, if the funds admit, a hall, to be called the Explorers' Hall, designed both to commemorate explorers and to serve as a meeting-place for the Society, should form a prominent feature in the new or rebuilt house; and that, even if no other step be taken, a Building Fund should be created with the object of accumulating capital for these purposes."

That resolution committed the Society to the principle that a change of quarters was desirable, if suitable premises, better adapted to our needs, could be found. Gentlemen, this was the state of affairs when you did me the honour of electing me your President in the past summer, and I may say in passing that

the main reason which induced me, in a life of considerable pre-occupation, to accept the presidency, was the opportunity of really carrying on this attempt to a successful issue. I stated this in the speech that I made at our anniversary dinner on May 26 last, and on July 4, I issued a letter in the newspapers, a copy of which was sent to every Fellow of the Society. Since then we have been very hard at work, and I can truthfully say that the whole of my autumn and winter has been spent in the issue of personal appeals to those who would be likely to help us. You may ask what has been the result? It has exceeded my most sanguine expectations. The best test will be the figures themselves. I referred just now to the old Building Fund initiated by Major Darwin in 1909. The amount that was promised and paid to that fund totalled £3420; in addition, during the last three years, we have had legacies, three of £1000 each, which we are able to devote to the acquisition of new premises. The new fund which I inaugurated on becoming President in the summer now amounts to £31,218 9s. 8*d.*, so that the Society has at its disposal a sum of £37,600 for the purchase of new premises, out of which £5000 alone have to be utilized for the repayment of a loan that was raised for the acquisition of the house in Vigo Street. This large sum of money has come from a great variety of sources. Fellows of the Society, as soon as they realized that there was a chance of success, have responded liberally to the appeal. The city companies and great firms, such as the P. and O., the British South Africa Company, the Burma Oil Company, and others have given large sums. It pleases me to be able to tell you that a good many of the Indian princes with whom I was brought into contact a few years ago, and who are well aware of the services that have been rendered to India by geographers, have given me substantial assistance, and have in several cases been willing to join the Society as Life Fellows. Lastly, and perhaps most successful of all, I am able to acquaint you with the fact that we have succeeded in persuading His Majesty's Government, who are, as a rule, more given to taking money from others than to giving it themselves, to raise their annual grant to us from £500 to £1250. I am sure you will agree with me that they have treated us with great and even extreme generosity. But I need hardly say that this annual addition is given on the understanding that we are going to move into quarters superior in every way to those which we at present enjoy. This contribution has not been counted in any way in the £37,000. In addition to raising the money, we have been very busy in Council in the last few months. We have visited a number of sites, and examined a number of buildings; we have had a competent architect to advise us, and have entered into preliminary negotiations with the owners of what might turn out to be suitable premises.

Here let me add that the object with which we are moving is capable of being quite clearly defined. In my opinion, the new premises, wherever we ultimately select them, ought to be reasonably near to the quarters where we at present reside. I say so because it is a very central position, convenient to the bulk of our Fellows, and also to Government officials who make frequent use of the facilities we afford. It is also close to the theatre which we are given the use of by the Civil Service Commissioners, and upon which, unless we are able to secure a site sufficiently large to enable us to build a hall for ourselves, we must continue to rely. Moreover, our present site is consecrated by the tradition and the practice of over forty years. The second condition that I would lay down is that our new quarters should be better and larger in every respect than the present ones. Thirdly, I think they ought to admit of that expansion which I hope—which I expect—for the Society in the future. And lastly, I think that they ought to add materially to the convenience of the Fellows themselves. If we are successful in obtaining a building that satisfies these conditions I have no doubt that the number of Fellows will increase

and that the revenue of the Society and its capacities for good will be proportionately augmented.

But it must be quite obvious to you that we cannot be on with the new love until we are off with the old. In other words, it is impossible for us to carry any negotiations to a successful issue until we know what is the value of our present quarters. A very material feature in the price that we may be called upon to give is a knowledge of what we shall obtain for 1, Savile Row and 6A, Vigo Street. You may ask, why not obtain a valuation of them? but I submit to any of you who are business men that the only real test of the value of a building, at any rate in London, is not what a valuer may put upon it, but what one can obtain for it either at an auction or in private negotiation. That test we can only apply by offering the building for sale, and it is in order to obtain your permission to do so that we have summoned this General Meeting to-day. Of course we shall only sell these premises if we can obtain a good price for them, and we must retain the right to remain in them for a certain period until we can shift our business and Fellows into the new quarters. If you give us your sanction to sell, and if we obtain a reasonable price, we shall then be able to resume negotiations before the summer is reached, and I hope that within a period of less than two years from now the Fellows of this Society will be enjoying premises more worthy of the great institution to which they belong. I will conclude with this motion: "That this meeting of the Society, summoned under the provisions of the Charter, approves of the proposal to offer the premises of the Society for sale, and sanctions the sale if effected."

Questions were then asked by a number of the Fellows as to the negotiations that had taken place, the site of new premises, and the further steps to be taken. Answers were given to these by the President; and the motion, having been seconded and put to the meeting, was carried with only a single dissentient.

RESEARCH DEPARTMENT.

January 18, 1912.

"The Settlement of Sediment in Running Water." By Dr. J. S. Owens.

Sixth Meeting, January 29, 1912.—Major Leonard Darwin, Vice-President, in the Chair.

Elections.—*Carl Bogler; Captain Colin Archibald Heron Campbell, R.A.; Thomas L. Eve; Robert James Finch; Charles L. Fox; Henry Cullen Gouldsbury; Herbert James Hanson; Oswald Hesketh Hanson, M.A.; Dr. Bruce Porter; Percy Collingwood Swan; William W. Thornton; Walter Hayle Walske; A. F. Wedgwood; A. V. Willcox.*

The Duke of Fife.

Major Darwin (Vice-President) said: I have a sad duty to perform. A report has just been placed in my hands, the authenticity of which cannot be doubted, of the death of the Duke of Fife at six o'clock this evening, The Duke was for long a Fellow of this Society, and he served on its Council some twenty years ago. Though we can, therefore, claim him as a geographer, there must be quite other thoughts now in our minds. We must all be feeling the tragic suddenness of the event, a suddenness which must add greatly to the suffering of his family. We cannot but recall at this moment how that now stricken family was such a little time ago rejoicing at their marvellous escape from a deadly peril. This is not the occasion to dilate on this subject, but I know I am expressing the feelings of all here present in saying

how sad we are that the magnificently successful voyage of His Majesty the King should be marred at its end by this terrible disaster.

The paper read was:—

"Exploration in the Canadian Rockies." By Prof. J. Norman Collie, F.R.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Dalmatia. **Brückner.**

Dalmatien und das österreichische Küstenland. Vorträge . . . herausgegeben im Auftrage . . . der Universität Wien von Prof. Dr. Ed. Brückner. Vienna, etc.: F. Deuticke, 1911. Size 8½ × 5½, pp. viii. and 250. *Sketch-maps and Illustrations. Price* 4m. *Presented by the Publisher.*

Europe—Waterways. **Ebner.**

Flösserei und Schiffahrt auf Binnengewässern, mit besonderer Berücksichtigung der Holztransporte in Österreich, Deutschland und Westrussland. Von Karl Ebner. Vienna, etc.: A. Hölder, 1912. Size 10 × 6½, pp. xvi. and 372. *Maps, Plans, Illustrations, and Diagrams. Price* 16*s.*

France—Vosges. **Betham-Edwards.**

In the heart of the Vosges, and other sketches by a "devious traveller." By Miss [M.] Betham-Edwards. London: Chapman & Hall, 1911. Size 9 × 6, pp. viii. and 328. *Illustrations. Price* 10*s.* 6*d. net.*

Germany—Gazetteer. **Petzold and Pelocke.**

Petzolds Gemeinde- und Ortslexikon des Deutschen Reiches. Verzeichnis sämtlicher Gemeinden und Gutsbezirke, Post-, Bahn-, Kleinbahn- und Schiffahrtsstationen, sowie aller nicht selbständigen Ortschaften, Kolonien, Weiler, etc., des deutschen Reichsgebiets, letztere bis zu 50 Einwohner abwärts. 2 . . . Auflage,

. . . zusammengestellt von Hermann Pelocke. Bischofswerda, 1911. Size 9½ × 6, pp. lxxii. and 1340. *Price* 20*s.*

Valuable for its exceedingly comprehensive character. The information on each place is limited to certain definite facts, which are given on a systematic plan.

Germany - Hessen—Geology. **Lepsius and others.**
Notizb. V.E. Darmstadt, Ser. IV. 31 (1910): 1–105.
Geologischer Führer durch das Grossherzogtum Hessen. Von R. Lepsius, G. Klemm, A. Steuer und W. Schottler.

Germany—Hessen—Survey. ——
Notizb. V.E. Darmstadt, Ser. IV. 30 (1909): 133–169; 31 (1910): 139–171.
Das Grossherzoglich Hessische Hauptnivellement. Bearbeitet und herausgegeben von Grossh. Hessischem Katasteramt zu Darmstadt.

Germany—Lake of Constance—Vegetation. **Baumann.**
Vegetationsbilder (ed. Karsten und Schenck) 9 (1911): Plates 13–18.
Vegetation des Untersees [Bodensee]. Eine pflanzenbiologische Skizze. Von Dr. Eugen Baumann.

Holland—Texel. *Petermanns M.* 57 (1911) II.: 197. **Kleinkemm.**
Die Strandmessungen der Kgl. Niederländischen Regierung auf der Insel Texel 1850–1906. Von Dr. H. Kleinkemm.

Italy. **Sladen.**
How to see Italy by rail. By Douglas Sladen. London: K. Paul & Co., 1912. Size 7 × 4½, pp. xxvi. and 566. *Map and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publishers.*

Italy—Cartography. *Petermanns M.* 57 (1911) II: 277–280. **Mori.**
Die moderne Kartographie des Königreichs Italien und seiner Kolonien. Von Attilio Mori. *Index-map.*

Italy—Liguria—Rainfall. *Mem. G., Rev. G. Italiana* (1911): 249–476. **Anfossi.**
Materiali per la climatologia d'Italia. II. La pioggia nella regione ligure. Memoria dell Ing. G. Anfossi. *Maps and Diagrams.*

North-West Europe—Belt. *Petermanns M.* 57 (1911) II.: 246–251. **Spethmann.**
Tiefenkarte der Beltsee. Von Dr. Hans Spethmann. *Chart and Diagrams.*

Portugal—Estoril—Plants. **Markham.**
List of plants collected round Estoril during three seasons, by Lady Markham and her friends, with an introduction by Sir Clements Markham. Lisbon, 1910. Size 8½ × 6, pp. 38. *Sketch-map.*

Russia—Baltic—Aland islands. **Maximof.**
Mem. Hydrography (Chief Hydrog. Dept.) 31 (1909): 63–124; 32 (1910): 12–55.
The triangulation of the Aland islands in 1908. By Captain G. Maximof. *Maps and Illustrations.* [In Russian.]

Russia, Central—Hydrology. *Zemleryedenie* 17 (1910): No. 2, 35–55. **Kuznetsof.**
Lakes and Swamps in Moscow and Vladimir Governments. By N. Kuznetsof. [In Russian.]

Switzerland—Trade-routes. **Härry.**
A. Härry. Die historische Entwicklung der schweizerischen Verkehrswege, mit besonderer Berücksichtigung des Transits und der Fluss-Schiffahrt. I. Teil. (Nordostschweizerischer Verband für Schiffahrt Rhein-Bodensee; Verbandsschrift Nr. 12.) Frauenfeld: Huber & Co., 1911. Size 10 × 7, pp. xvi. and 276. *Facsimile Plans, Profiles, and Diagrams. Price* 10*s.*

United Kingdom—London. **Besant.**
London City. By Sir Walter Besant (pp. xii. and 492). London North of the Thames. By the same (pp. xii. and 682). London: A. & C. Black, 1910–11. Size 11½ × 9. *Plans and Illustrations. Price (each)* 30*s. net.*
The first two volumes of a topographical survey of London at the close of the nineteenth century.

United Kingdom—Sussex. **Hannah.**
The Sussex Coast. By Ian C. Hannah. London: T. Fisher Unwin, 1912. Size 8 × 5, pp. 410. *Illustrations. Price* 6*s. net. Presented by the Publisher.*

ASIA.

Arabia. **Zwemer.**

Zigzag journeys in the camel country. Arabia in picture and story. By Samuel M. Zwemer and Amy E. Zwemer. London, etc.: F. H. Revell Co., [1911]. Size 8½ × 5½, pp. 126. *Illustrations. Price* 2*s.* 6*d. net.*

China. **Bell and Woodhead.**

The China Year-Book, 1912. By H. L. Montague Bell and H. G. W. Woodhead. London: G. Routledge & Sons, [1912]. Size 8 × 5, pp. xxxvi. and 464. *Price* 10*s. net. Presented by the Publishers.*

China—Islam. **D'Ollone and others.**

Mission d'Ollone, 1906–1909. Recherches sur les musulmans chinois. Par le Commandant d'Ollone, le Capitaine de Fleurelle, le Capitaine Lepage, et le Lieutenant de Boyve. Etudes de A. Vissière; Notes de E. Blochet. Paris: E. Leroux, 1911. Size 11 × 7½, pp. xii. and 472. *Map and Illustrations. Price* 15 *fr. Presented by Commandant d'Ollone.*

Chinese Turkestan. **Stein.**

Ruins of desert Cathay. Personal narrative of explorations in Central Asia and Westernmost China. By M. Aurel Stein. 2 vols. London: Macmillan & Co., 1912. Size 9½ × 6½, pp. (vol. 1) xxxviii. and 546; (vol. 2) xxii. and 518. *Map and Illustrations. Price* 42*s. net. Presented by the Publishers.*

India. **Handley.**

Roughing it in Southern India. By Mrs. M. A. Handley. London: E. Arnold, 1911. Size 9 × 6, pp. xii and 300. *Illustrations. Price* 12*s.* 6*d. net.*

India. *Z. Ges. E. Berlin*, 1911 : 521–542. **Wegener.**

Das heutige Indien. Grundlagen und Probleme der britischen-indischen Herrschaft. Von Prof. Dr. Georg Wegener. *Sketch-map.*

India—Godavari. *B.G.S. Philadelphia* 9 (1911) : 169–186. **Cushing.**

The Geography of Godavari—A district in India. *Illustrations and Sections.*

India—Himalaya. *Iz. Imp. Russ. G.S.* **46** (1910) : 53–101. **Rieznichenko.**

The Mustagh glacier group. By V. Rieznichenko. *Illustrations.* [In Russian.]

India—Historical. **Master and Temple.**

Indian Records Series. The diaries of Streynsham Master, 1675–1680, and other contemporary papers relating thereto. Edited by Sir Richard Carnac Temple. Two vols. London: J. Murray, 1911. Size 9 × 6, pp. (vol. i.) xvi. and 506; (vol. ii.) x. and 484. *Sketch-map and Portrait. Price* 24*s. net. Presented by the Publisher.*

India—Historical. **Robinson.**

The trade of the East India Company from 1709 to 1813. By F. P. Robinson. Cambridge: University Press, 1912. Size 7½ × 5, pp. viii. and 186. *Price* 3*s.* 6*d. net. Presented by the Author.*

India—Kashmir. *Z. Gletscherkunde* **6** (1911) : 1–30. **Oestreich.**

Der Tschochogletscher in Baltistan. Von Karl Oestreich. *Maps.*

India—Political. **Fraser.**

India under Curzon and after. By Lovat Fraser. London: W. Heinemann, 1911. Size 10 × 6½, pp. xii. and 496. *Map and Illustrations. Price* 16*s. net.*

India—Sikkim—Vegetation. **Smith and Cave.**
Records Botanical Surv. India **4** (1911) : 141–260.

The Vegetation of the Zemu and Llonakh valleys of Sikkim. By W. W. Smith and G. H. Cave. *Illustrations and Maps.*

Indo-China—Races. *Petermanns M.* **59** (1911) II.: 199–200. **Hosseus.**

Siamesische Stämme in Südchina und Französisch-Indochina. Von Dr. C. C. Hosseus.

Malay Archipelago—Sumatra. **Volz.**

Nord-Sumatra. Bericht über eine im Auftrage der Humboldt-Stiftung der K. Preussischen Akademie der Wissenschaften zu Berlin in den Jahren 1904–1906 ausgeführte Forschungsreise. Von Prof. Dr. Wilhelm Volz. Bd. II.: Die Gajoländer. Berlin: D. Reimer, 1912. Size 10½ × 7, pp. xxii. and 428. *Maps and Illustrations. Price* 18*m. Presented by the Publisher.*

The first volume was reviewed in February, 1911 (vol. **37**, p. 201).

Malay Archipelago—Teon. **Wichmann.**
K.A. Wetens. Amsterdam, P. Section Sc. **13** (1910–11): 485–489.
On the volcanic eruption in the island of Téon (Tijau) in 1659. By Prof. Arth. Wichmann. *Charts.*

AFRICA.

Abyssinia. *Le Tour du Monde* **17** (1911): 409–480. **Rémond.**
Excursions et Chasses en Abyssinie. (D'Addis-Ababa à Khartoum.) Par Georges Rémond. *Sketch-map and Illustrations.*

Abyssinia—Historical. **Beccari.**
Rerum Æthiopicarum scriptores occidentales inediti a sæculo XVI. ad XIX., curante C. Beccari, S.J. Vol. 11: Relationes et epistolæ variorum, Pars i., Liber ii. Rome: C. de Luigi, 1911. Size 10½ × 7½, pp. x. and 562. *Price* 20*s.* 8*d.*
Entirely concerned with letters of Paez.

Africa—German Colonies. **Thomsen.**
Deutsches Land in Afrika. Von Dr. Hermann Thomsen. Munich: Verlag d. Deutschen Alpenzeitung, 1911. Size 10½ × 7½, pp. viii. and 188. *Maps and Illustrations. Price* 16*s.*
Sketches of travel in East and South-West Africa. The coloured illustrations give a vivid idea of the various types of country.

Algeria. **Thomas-Stanford.**
About Algeria, Algiers, Tlemçen, Constantine, Biskra, Timgad. By Charles Thomas-Stanford. London: J. Lane, 1912. Size 7½ × 5, pp. 306. *Map and Illustrations. Price* 5*s. net. Presented by the Publisher.*

Belgian Congo. **Roby.**
My adventures in the Congo. By Marguerite Roby. London: E. Arnold, 1911. Size 9 × 6, pp. xii. and 310. *Map and Illustrations. Price* 12*s.* 6*d. net.*

British East Africa.—Kikuyu. **Boyes.**
Joyn Boyes, King of the Wa-Kikuyu. A true story of travel and adventure in Africa, written by himself. Edited by C. W. L. Bulpett. London: Methuen & Co., [1911]. Size 9 × 5½, pp. xvi. and 320. *Sketch-map and Illustrations. Price* 12*s.* 6*d. net.*

East Africa—Economic. **Brode.**
British and German East Africa: their economic and commercial relations. By Dr. H. Brode. London: E. Arnold, 1911. Size 9 × 6, pp. xiv. and 176. *Map and Illustrations. Price* 7*s.* 6*d. net.*

Egypt—Geology. **Hume.**
Ministry of Finance, Egypt. Survey Department. The principles and objects of Geology, with special reference to the Geology of Egypt. By Dr. W. F. Hume. Cairo, 1911. Size 10½ × 7, pp. 26. *Illustrations and Sections.*

Egyptian Sudan. **Balfour.**
Fourth report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartum. Andrew Balfour, Director. Published for the Department of Education, Sudan Government. Two vols. London: Baillière, Tindall & Cox, 1911. Size 11 × 8, pp. (vol. A) 404; (vol. B) 334. *Maps and Illustrations. Price* 39*s. net. Presented by the Publishers.*

Egyptian Sudan. *Rev. Économique internationale* **3** (1911): 470–513. **Arminjon.**
La valeur économique du Soudan anglo-égyptien. Par P. Arminjon.

French Equatorial Africa—Waterways. **Roussilhe.**
La G., B.S.G. Paris **24** (1911): 243–248.
Mission hydrographique Congo—Oubangui—Sangha. Par H. Roussilhe.
See note in the November number, p. 532.

French West Africa. *C.R.A. Sc. Paris* **153** (1911): 737–740. **Hubert.**
Essai d'une Carte géologique de l'Afrique occidentale. Par Henry Hubert.

French West Africa. *C.R.A. Sc. Paris* **153** (1911): 805–808. **Hubert.**
Sur la forme parabolique des accidents du relief constitués par les roches cristallines acides en Afrique occidentale. Par Henry Hubert.

French West Africa. **Sonolet.**

Louis Sonolet. L'Afrique occidentale française. Paris: Hachette et Cie., 1912. Size 7½ × 5, pp. 256. *Sketch-map and Illustrations. Price 5 fr. 50. Presented by the Publishers.*

Morocco—Atlas. *Petermanns M.* 57 (1911) II.: 237-240. **Hübner.**

Die Hauptübergänge des westlichen Hohen Atlas. Von Oberstleutn. z. D. Hübner. *Sketch-map.*

Morocco—Cartography. *Petermanns M.* 57 (1911) II.: 257-261, 313-322. **Schnell.**

Zur Kartographie Nordmarokkos. I. Das Bergland westlich von Fas. Route durch den Djebel Sarhun. Von Prof. P. Schnell. *Maps.*

Nigeria, Northern—Ethnology. **Tremearne.**

The tailed head-hunters of Nigeria: an account of an official's seven years' experiences in the Northern Nigerian pagan belt, and a description of the manners, habits, and customs of the native tribes. By Major A. J. N. Tremearne. London: Seeley, Service & Co., 1912. Size 9 × 5½, pp. 342. *Sketch-map and Illustrations. Price 16s. net. Presented by the Publishers.*

Nigeria, Northern—Language. **Benton.**

Kanuri readings, including facsimiles of MSS., transliteration, interlinear translation and notes; also a complete English-Kanuri Vocabulary and a partial Kanuri-English Vocabulary. By P. Askell Benton. Oxford: H. Frowde, 1911. Size 7 × 4½, pp. 110 and x. *Price 6s. net. Presented by the Author.*

Rhodesia. **Letcher.**

Big game hunting in North-Eastern Rhodesia. By Owen Letcher. London: J. Long, Ltd., 1911. Size 9 × 5½, pp. 266. *Map and Illustrations. Price 12s. 6d. net. Presented by the Author.*

A well-written book on its subject, though dealing little with geography.

South Africa—Cape Colony. **Playne.**

Cape Colony (Cape Province): its history, commerce, industries, and resources. Compiled and edited by Somerset Playne. London: Foreign & Colonial Publishing Co., 1910-1911. Size 12½ × 9½, pp. 792. *Sketch-map and Illustrations. Price 25s. net. Presented by the Editor.*

South Africa—Kalahari. **Hodson.**

Trekking the Great Thirst: travel and sport in the Kalahari desert. By Arnold W. Hodson. London: T. Fisher Unwin, 1912. Size 9 × 6, pp. 360. *Sketch-map and Illustrations. Price 12s. 6d. net. Presented by the Publisher.*

South Africa—Natal. **Tatlow.**

Natal province: descriptive guide and official handbook. Edited by A. H. Tatlow. Durban (London: Simpkin & Co.), 1911. Size 10½ × 7½, pp. xii. and 574. *Maps and Illustrations. Price 7s. 6d. Presented by the Publishers.*

South Africa—Zulus. **Gibson.**

The story of the Zulus. By J. Y. Gibson. New edit. London: Longmans & Co., 1911. Size 9 × 6, pp. viii. and 338. *Illustrations. Price 7s. 6d.*

Tripoli. **Ghisleri.**

Arcangelo Ghisleri, Tripolitania e Cirenaica, dal Mediterraneo al Sahara. Monografia storico-geografico. Milan, etc.: Società Editoriale Italiana, etc., 1912. Size 10½ × 7½, pp. 200. *Maps and Illustrations. Presented by the Publishers.*

Tripoli. **Mathuisieulx.**

H.-M. de Mathuisieulx. La Tripolitaine d'hier et de demain. Paris: Hachette & Cie., 1912. Size 7½ × 5, pp. viii. and 222. *Sketch-maps and Illustrations. Price 5 fr. 50. Presented by the Publishers.*

West Africa. **Gaunt.**

Alone in West Africa. By Mary Gaunt. London: T. Werner Laurie, [1912]. Size 9 × 5½, pp. xx. and 404. *Illustrations. Price 15s. net. Presented by the Publisher.*

NORTH AMERICA.

Alaska—Eskimo. *Univ. Pennsylvania, T. Dept. Archæology* 2 (1906): 69-101. **Gordon.**

Notes on the Western Eskimo. (First paper.) By G. B. Gordon. *Illustrations.*

Alaska—Geology. **Brooks and Prindle.**

U. S. Geol. Surv. Professional Paper **70** (1911): pp. 234.

The Mount McKinley Region, Alaska. By Alfred H. Brooks; with descriptions of the igneous rocks and of the Bonnifield and Kantishna districts by L. M. Prindle. *Maps, Sections, and Illustrations.*

Canada. **Copping.**

Canada to-day and to-morrow. By Arthur E. Copping. London, etc.: Cassell & Co., 1911. Size 8½ × 5½, pp. xii. and 276. *Illustrations. Price 7s. 6d. net.*

Somewhat miscellaneous notes on matters Canadian.

Canada—Alberta. **Thwaite.**

Porter's Progress of Nations. Alberta: an account of its wealth and progress. By Leo Thwaite. London: G. Routledge & Sons, 1912. Size 8 × 5, pp. 250. *Sketch-map and Illustrations. Price* 1*s. net. Presented by the Publishers.*

Canada—Alberta—Coal. **Malloch.**

Canada. Department of Mines. Geological Survey Branch. Memoir No. 9 E. Bighorn coal basin, Alberta. By G. S. Malloch. Ottawa, 1911. Size 10 × 6½, pp. 66. *Maps and Illustrations.*

Canada—Alberta—Survey. *P.I. Civil Engineers* **185** (1910-11): 252-262. **Newlands.**

Topographical Surveys on the Canadian Pacific Railway Irrigation Scheme. By John Eric Newlands. *Plan.*

Canada—Boundary. *United Empire* **2** (1911): 683-712. **Mills.**

British Diplomacy and Canada. The Ashburton Treaty. By Lieut.-Colonel Dudley A. Mills. *Maps and Diagrams.*

Deals only with the eastern section of the southern boundary.

Canada—Rockies. **Fay.**

The Canadian Rocky Mountains. By Prof. Charles E. Fay. (*Alpina Americana*, No. 2, 1911.) Philadelphia, 1911. Size 13½ × 11, pp. 20. *Maps and Illustrations.*

Canada—Rockies. *Appalachia* **12** (1911): 226-236. **Hickson.**

Some climbs in the Canadian Rockies in 1910. By J. W. A. Hickson. *Illustrations.*

Mexico. **Gillpatrick.**

Wanderings in Mexico: the spirited chronicle of adventure in Mexican highways and byways. By Wallace Gillpatrick. London: Eveleigh Nash, 1912. Size 8½ × 5½, pp. xvi. and 374. *Illustrations. Price 7s. 6d. net. Presented by the Publisher.*

Mexico. **Périgny.**

Cte. Maurice de Périgny. Les États-Unis de Mexique. Paris: E. Guilmoto, [1911]. Size 9 × 5¾, pp. xii. and 310. *Sketch-map. Price 5 fr. 50. Presented by the Publisher.*

United States—Commerce. **Ross.**

The Western Gate (or, The maritime district of Western Washington and a new American mercantile marine). By Patrick H. W. Ross. New York: Dodd, Mead & Co., 1911. Size 8 × 5, pp. iv. and 154, *Price 75 cts. Presented by the Author.*

CENTRAL AND SOUTH AMERICA.

Argentina. **Lloyd and others.**

Twentieth Century impressions of Argentina: its history, people, commerce, industries, and resources. [Edited by] Reginald Lloyd, W. Feldwick, Oliver T. Breakspear, L. T. Delaney, and Arnold Wright. London, etc.: Lloyd's Greater Britain Publishing Co., 1911. Size 12½ × 9½, pp. 850. *Maps, Illustrations, and Diagrams. Presented by the Publishers.*

Brazil. **Schüler.**

Brasilien: ein Land der Zukunft. Von Heinrich Schüler. 2. Auflage. Stuttgart, etc.: Deutsche Verlags-Anstalt, 1912. Size 10 × 6½, pp. xii. and 480. *Map and Illustrations. Price* 10*m.*

A useful general account of the country and its resources, by one who has resided in Brazil for a quarter of a century.

Brazil—Goyaz. **Glass.**

A thousand miles in a dug-out; being the narrative of a journey of investigation among the Red-skin Indians of Central Brazil. By Frederick C. Glass.

[Liverpool]: South American Evangelical Mission, 1911. Size 7½ × 5, pp. viii. and 86. *Sketch-map and Illustrations. Presented by the Author.*

Brazil—Mato Grosso and Goyaz. **Glass.**

Through the heart of Brazil. A diary of journey and adventure during a Gospel expedition of about 5000 miles by river, rail, and road, in and around Brazil, with some information about the interior inland tribes. By Frederick C. Glass. Liverpool: South American Evangelical Mission, [*not dated*]. Size 8½ × 6½, pp. iv. and 136. *Illustrations. Presented by the Author.*

Chile. **Canto.**

Porter's Progress of nations. Chile: an account of its wealth and progress. By Julio Perez Canto. London: G. Routledge & Sons, 1912. Size 8 × 5, pp. 252. *Map. Price* 1*s. net. Presented by the Publishers.*

Panama Canal. **Fiegel**

Der Panamakanal: die Bedeutung des Kanalbaues; seine Technik und Wirtschaft. Von Max D. Fiegel. Berlin: D. Reimer, 1911. Size 9 × 6, pp. viii. and 184. *Sketch-map and Illustrations. Price* 4*m. Presented by the Publisher.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. **Jose.**

History of Australasia from the earliest times to the present day, with a chapter on Australian literature. By Arthur W. Jose. 4th edit. Sydney [London: The Australian Book Co.], 1911. Size 7½ × 5, pp. xiv. and 320. *Maps and Illustrations. Price* 3*s.* 6*d. net. Presented by the Publishers.*

Bismarck Archipelago. **Vogel.**

Eine Forschungsreise im Bismarck-Archipel. Bearbeitet von Hans Vogel. Hamburg: L. Friederichsen & Co., 1911. Size 10½ × 8, pp. xvi. and 308. *Map and Illustrations. Price* 16*s.*

POLAR REGIONS.

Arctic. **Orleans.**

Hunters and hunting in the Arctic. By the Duke of Orleans. London: D. Nutt, 1911. Size 9 × 5½, pp. xxvi. and 204. *Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.*

MATHEMATICAL GEOGRAPHY.

Astronomy—Star-map. **Turner.**

The great star map; being a brief general account of the International project known as the Astrographic Chart. By Dr. H. H. Turner. London: J. Murray, 1912. Size 7½ × 5, pp. viii. and 160. *Illustration. Price* 2*s.* 6*d. net. Presented by the Publisher.*

Navigation. **Cross.**

The new navigation, presented in a familiar way for Captains and Officers of the Merchant Service. By F. C. Cross. Glasgow: J. Brown & Son, 1911. Size 8½ × 5½, pp. 30. *Diagrams. Price* 2*s. net. Presented by the Publishers.*

Surveying—Historical. **Soldner and Frischauf.**

Theorie der Landesvermessung. Von Johann Soldner (1810). Herausgegeben von J. Frischauf. Leipzig: W. Engelmann, 1911. Size 7½ × 5, pp. 76. *Diagrams. Price* 1.60*m.*

Reprint of an early work on the subject.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Glaciers. **Rabot.**

Revue de glaciologie. No. 3 (Avril, 1903—1re Janvier 1907). Par Charles Rabot. (Mémoires de la Société Fribourgoise des Sciences Naturelles: Géologie et Géographie, No. 5.) Fribourg, 1909. Size 9½ × 6½, pp. 344. *Maps and Illustrations. Presented by the Author.*

Hydrology. **Richert.**

Die Grundwasser, mit besonderer Berücksichtigung der Grundwasser Schwedens. Von J. Gust. Richert. Munich, etc.: R. Oldenbourg, 1911. Size 10 × 6½, pp. vi. and 106. *Maps and Sections. Price* 4*s.* 6*d.*

Meteorology. **Fowler and Marriott.**

Our weather. By J. S. Fowler and William Marriott. London: J. M. Dent & Sons, 1911. Size 6 × 4, pp. xii. and 132. *Sketch-maps, Illustrations, and Diagrams. Price* 1*s. net. Presented by the Publishers.*

Meteorology. **Shaw.**

Forecasting weather. By Dr. W. N. Shaw. London: Constable & Co., 1911. Size 9 × 5½, pp. xxviii. and 380. *Sketch-maps and Diagrams. Price* 12*s.* 6*d. net. Presented by the Publishers.*

Meteorology—Tables. **Jelinek and others.**

Jelineks Psychrometer-Tafeln. Anhang: Hydrometer-Tafeln von J. M. Pernter. 6. Auflage; herausgegeben von W. Trabert. Leipzig: W. Engelmann, 1911. Size 13½ × 10, pp. xii. and 130. *Price* 7*m. Presented by the Publisher.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial. **Hennig.**

Von Deutschlands Anteil am Weltverkehr. Von D. Richard Hennig. 2. Auflage. Berlin. Allgemeiner Verein für Deutsche Literatur, 1911. Size 9 × 6, pp. 304. *Price* 5*s.*

Commercial—Fisheries. **Hérubel.**

Sea fisheries: their treasures and toilers. By Marcel A. Hérubel. London: T. Fisher Unwin, 1912. Size 9 × 6, pp. 366. *Diagram. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Historical Geography. **Berry.**

The association of history and geography. By A. J. Berry. London: Blackie & Son, 1911. Size 7 × 5, pp. 172. *Price* 1*s.* 6*d. net. Presented by the Publishers.*

Hygiene. **Balfour and Archibald.**

Second review of some of the recent advances in tropical medicine, hygiene and tropical veterinary science. (Being a supplement to the Fourth Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum.) By Andrew Balfour and Captain R. G. Archibald. Published for the Department of Education, Sudan Government. London: Baillière, Tindall & Cox, 1911. Size 11 × 8, pp. 448. *Illustration. Price* 15*s. net.*

GENERAL.

Geography—Text-book. **Wallis.**

A geography of the world. By B. C. Wallis. London: Macmillan & Co., 1911. Size 7½ × 5, pp. xvi. and 372. *Sketch-maps, Illustrations, and Diagrams. Price* 3*s.* 6*d. Presented by the Publishers.*

German Colonies—Resources. **Grotewold.**

Unser Kolonialwesen und seine wirtschaftliche Bedeutung. Von Dr. Chr. Grotewold. Stuttgart: E. H. Moritz, 1911. Size 7 × 4½, pp. 278. *Maps and Illustrations. Price* 8*m.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria. **Deutschen u. Oesterreichischen Alpen Verein.**

Karte der Lechtaler-Alpen. Herausgegeben v. Deutschen u. Oesterreichischen Alpen Verein. Scale 1:25,000 or 25 inches to 1 stat. mile. Vienna: G. Freytag & Berndt, 1911. *Presented by the Publishers.*

The Lechtal Alps lie to the north of the Inn in the Tyrol, immediately north-west of Landëck, and the above map is from a new topographical survey by Herr L. Aegerter, based upon the Austrian Government triangulation. In general style it resembles the well-known Swiss survey sheets, and shows contours at 20-metres intervals, in the lower land in brown, on the glaciers in blue, and on the high rocky slopes in black. Rocks and peaks not contoured are shown by black vertical hachuring, and water in blue. Attempt has been made to give greater effect to the relief by oblique

illumination, the light being stated in a note to fall from the south-east; but this has hardly been consistently carried out in some parts of the map. Taken as a whole, the map is a remarkably good piece of cartographical work, and effectively represents the relief of this decidedly complicated district. It is published by the German and Austrian Alpine Club, and appears as a supplement to its "Zeitschrift" for 1911 (Band xlii.), accompanied by an interesting descriptive article on the region.

Austria-Hungary. **Artaria.**

Artaria's Eisenbahnkarte von Oesterreich-Ungarn und den Balkanlandern. Mit 9 Nebenkarten und Plänen und Vollständigem Stationsverzeichnis, 1912. Scale 1 : 1,400,000 or 1 inch to 22·1 stat. miles. Vienna: Artaria & Co., 1912. *Price* 2.40 *kr.* ***Presented by the Publishers.***

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1912.

1-inch scale maps:—

England and Wales. Large sheet series. Printed in colours and folded in cover or flat in sheets. **Sheets** 78, 80, 90. *Price, on paper,* **1***s.* 6*d.; mounted on linen,* 2*s. mounted in sections,* 2*s.* 6*d. each.*

3rd edit. Special maps of towns and country around. Flat in sheets or folded in cover, with roads printed in colours. Sheffield and the Peak. *Price, on paper,* **1***s.* 6*d.; mounted on linen,* 2*s.*

6-inch scale maps:—

Cheshire, 7 sheets. **Hampshire,** 8 sheets. **Lancashire,** 3 sheets. **Sussex,** 3 sheets. **Yorkshire,** 10 sheets. *Price* 1*s. each.*

1 : 2500 scale maps:—

With houses stippled and with areas.

Berkshire, 34 sheets. **Cheshire,** 4 sheets. **Flintshire,** 2 sheets. **Lancashire,** 14 sheets. **Sussex,** 48 sheets. **Yorkshire,** 62 sheets. *Price* 3*s. each.*

(*E. Stanford, London Agent.*)

British Isles—Ireland. **Railway Clearing House.**

Official Railway Map of Ireland. Scale 1 : 475,200 or 1 inch to 7·5 stat. miles. 2 sheets. Prepared and published at the Railway Clearing House, London, 1912. *Price* 8*s.* 6*d.*

British Isles—London. **Stanford.**

A new map of Metropolitan Railways, Tramways, and Miscellaneous Improvements, deposited at the London County Council, November 30, 1911, for Session 1912. Scale 1 : 63,360 or 1 inch to 1 stat. mile. London: Edward Stanford, 1912. *Price* 2*s.*

Central Europe. **K. Preuss. Landesaufnahme.**

Uebersichtskarte von Mitteleuropa. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: Basel; Frankfort a. M.; Innsbruck; Konstanz; München. Berlin: R. Eisenschmidt, 1911. *Price* 1.50*m. each sheet.*

Europe. **Stanford.**

Stanford's Geological map of Central Europe. Scale 1 : 6,336,000 or 1 inch to 100 stat. miles. London: Edward Stanford, 1911. *Price* 5*s.*

A small geological map, extending from England to Italy and the northern half of Spain, and from the Atlantic to Servia. The geological features have been generalized and reduced from the Carte géologique internationale de l'Europe, 1 : 1,500,000.

France. **Dosseray-Rivière & Cie.**

Carte de la Région du nord de la France y compris 9 Départements, toutes les Communes, ainsi que toute la Belgique devisée en Arrondissements et Routes pour cyclistes et automobiles et chemins de fer vicinaux. Scale 1 : 320,000 or 1 inch to 5 stat. miles. [Paris]: R. Dosseray-Rivière & Cie., 1910.

France. **Goury.**

Plan du Port de Dunkerque et des travaux d'extension projetés. Scale 1 : 10,000 or 6·3 inchs to 1 stat. mile. Paris: G. Goury, 1911.

France. **Ministre de l'Intérieur.**

Carte de la France, dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: vi.–18, Vannes; viii.–10, Les Prieux; ix.–35,

Bayonne; x.–26, Royan; x.–35, Orthez; xii.–24, Ruffec; xiii.–11, Pont-Audemer; xiv.–20, Loches; xv.–7, Montreuil; xvi.–25, Aubusson; xvii.–10, Montdidier; xviii.–36, Narbonne; xxi.–33, Nimes. Paris: Hachette & Cie., 1911. *Price 0.80 fr. each sheet.*

These are new editions.

Mediterranean. **Bacon.**

Region of the Mediterranean and near East. Scale 1: 4,000,000 or 1 inch to 63·1 stat. miles. 2 sheets. London: G. W. Bacon & Co., Ltd., 1912. *Price* 15*s. Presented by the Publishers.*

A general map, printed in colours, showing the Mediterranean sea and countries bordering upon it, and extending from the Atlantic ocean to the Caspian sea and the Persian gulf. International boundaries are clearly marked, as are also railways, navigable rivers, and steamship routes, the latter having the distances in miles between ports marked upon them. Unfortunately the whole basis of the map is decidedly out of date. There is an index to ports, given in tabular form in the south-west corner of the map.

Rumania. **Military Geographical Institute, Bukarest.**

Map of Rumania. Scale 1: 50,000 or 1·3 inch to 1 stat. mile. Sheets: viii.–Q, Soimari; xxi.–O, Potlogi; xxii.–O, Obedeni. Bukarest: Military Geographical Institute, 1911.

ASIA.

Asia. **Bachmann.**

Verbreitung und Intensität des Reisbaus in Asien. Entworfen von Dr. C. Bachmann. Scale 1: 30,000,000 or 1 inch to 473·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1912, I., Tafel 4. Gotha: Justus Perthes, 1912. *Presented by the Publisher.*

China. **Brunhuber and Schmitz.**

Uebersicht der Reise von Dr. Robert Brunhuber und Karl Schmitz von Bhamo durch Jünnan nach Omati. Scale 1: 1,500,000 or 1 inch to 23·6 stat. miles.—Sechs Reisetag von Dr. Brunhuber und Schmitz am mittleren Salween in Jünnan vom 8. bis 13. Dez. 1908. Scale 1: 150,000 or 1 inch to 2·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1912, I., Tafel 7. Gotha: Justus Perthes, 1912. *Presented by the Publisher.*

China. **Langhans.**

Aufstandsgebiete und europäische Interessen in China. Scale 1: 5,000,000 or 1 inch to 78·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1912, I., Tafel 15. Gotha: Justus Perthes, 1912. *Presented by the Publisher.*

China. **Stanford.**

China. London Atlas Series. Scale 1: 6,000,000 or 1 inch to 94·7 stat. miles. London: Edward Stanford, 1911. *Price* 3*s.*

The map from Stanford's London Atlas, revised, and showing in red the boundaries of the new viceroyalties, as well as those of the provinces. These divisions are not usually shown on maps, and whatever changes may take place before long, the map will be useful as a record.

Russia in Asia. **Military Topographical Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. Scale 1: 1,168,031 or 1 inch to 18·4 stat. miles. Sheets: III., Tobolsk, Akmolinsk; XI., Kasalinsk, Turkestan. St. Petersburg: Military Topographical Department, 1910–11.

Sumatra. **Topographical Bureau, Batavia.**

Schetskaart van de Residentie Djambi. Scale 1: 300,000 or 1 inch to 4 stat. miles. 2 sheets. Batavia: Topographical Bureau, 1910.

AFRICA.

Africa. **Czekanowski.**

Ethnographische Uebersichtskarte des Nil-Kongo-Zwischengebeites, bearbeitet von Dr. Jan Czekanowski. Scale 1: 1,500,000 or 1 inch to 23·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1912, I., Tafel 11. Gotha: Justus Perthes, 1912. *Presented by the Publishers.*

Africa. **Geographical Section, General Staff, War Office.**

Africa. Scale 1: 250,000 or 1 inch to 3·9 stat. miles. Sheet: South A 37–U. Voi (East Africa Protectorate). Compiled under the direction of the Director of Surveys, East Africa Protectorate; drawn at the School of Military Engineering,

Chatham, and printed for the War Office by the Director-General of the Ordnance Surveys, Southampton. London: E. Stanford, Sifton Praed, T. Fisher Unwin, [1912]. *Price* 1*s.* 6*d. net. Presented by the Director of Military Operations.*

Algeria. **Service Géographique de l'Armée, Paris.**

Territories du Sud de l'Algérie. Scale 1:100,000 or 1 inch to 1·6 stat. miles. Sheet: El Hadjira. Paris: Service Géographique de l'Armée, 1911.

This map is eventually to consist of six sheets, and will include an extensive region of the Algerian Sahara. It has been prepared from recent route traverses and compass sketches of French officers, and is only a provisional issue.

Algeria. **Service Géographique de l'Armée, Paris.**

Region du Haut Guir. Scale 1:100,000 or 1 inch to 1·6 stat. mile. 3 sheets. Paris: Service Géographique de l'Armée, 1911.

The Haut Guir is situated in the Morocco-Algerian frontier region, in about lat. 32° N. and long. 4° E. This map has been heliographed and printed at the Service Géographique de l'Armée, in brown and black. It is only a provisional issue, produced from the route surveys of French military officers.

Belgian Congo. **Institute Cartographique Militaire, Brussels.**

Carte du Congo Belge. Scale 1:4,000,000 or 1 inch to 63·1 stat. miles. Brussels: Falk Fils, 1911.

This is a new edition.

Egypt. **Egyptian Survey Department.**

Topographical map of Egypt. Scale 1:10,000 or 6·3 inches to 1 stat. mile. Sheets: N.E. 10–12, 11–13, 12–12, 12–14, 12–15, 12–16, Mudiria Sharqia; N.E. 29–8, 30–1, 30–2, 30–3, 30–4, N.W. 26–1, 28–6, 29–7, 30–1, 30–2, 30–3, 30–4, Mudiria Gharbia; N.W. 25–8, 26–9, Mudiria Beheira. Giza: Survey Department, 1911. *Presented by the Director-General, Egyptian Survey Department.*

Egypt. **Egyptian Survey Department.**

Topographical map of Egypt. Scale 1:50,000 or 1·3 inches to 1 stat. mile. 2nd edit. Sheets: N.E. I.–II., Cairo East; I.–VII. Shallûfa; II.–III., Gheita; II.–VI., Great Bitter Lake; II.–VII., Little Bitter Lake; III.–VI., Ismailia. S.E. I.–II., Helwan; I.–VI., G. Etâqa; I.–VIII., Suez. Giza: Survey Department, 1910–1911. *Presented by the Director-General, Egyptian Survey Department.*

Morocco. **Service Géographique de l'Armée, Paris.**

Colonnes de Fes, 1911. Scale 1:100,000 or 1 inch to 1·6 stat miles. 4 sheets.—Colonne des Zaïr, 1910. Scale 1:100,000 or 1 inch to 1·6 stat. miles.—Kasba Merchouch. Scale 1:100,000 or 1 inch to 1·6 stat. miles.—La Chaouïa. Scale 1:500,000 or 1 inch to 7·8 stat. miles.—Rabat-Fes, Carte des Etapes. Scale 1:500,000 or 1 inch to 7·8 stat. miles. Paris: Service Géographique de l'Armée, 1911.

A series of provisional and hastily produced maps of various parts of Morocco from the route sketches of French officers, and issued by the Service Géographique de l'Armée for use during military operations.

North Africa. **Service Géographique de l'Armée, Paris.**

Confins Algéro-Marocains. Scale 1:200,000 or 1 inch to 3·2 stat. miles. Paris: Service Géographique de l'Armée, 1911.

A sketch-map of a part of the Algeria-Morocco frontier regions, prepared by the Service Géographique de l'Armée from the surveys and sketches of French officers. Relief is in brown horizontal form lines.

North Africa. **Service Géographique de l'Armée, Paris.**

La Frontière Tuniso-Tripolitaine. Scale 1:200,000 or 1 inch to 3·2 stat. miles. 8 sheets. Paris: Service Géographique de l'Armée, 1911.

Photo-lithographic reproductions on the scale of 1:100,000 of the original 1:80,000 survey sheets. The boundary extends from Ras Ajedir on the coast to Ghadames, and a sketch-map with a short note on the survey of the line was given in the *Geographical Journal* for July, 1911. Relief is shown by brown contours at 25-metre intervals.

Portuguese East Africa. **Ministerio da Marinha e Colonias, Lisbon.**

Africa Oriental Portugueza. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. Sheet 4, Zumbo-Tete. Lisbon: Ministerio da Marinha e Colonias, 1911.

Tripoli. **Galli.**

Pio Galli: Carta dimostrativa della Tripolitania. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. 2 sheets. Milan: Antonio Vallardi, [1912].

A general map of Tripoli and Cirenaica, drawn in a bold style, and showing principal explorers' routes. It is printed in colours, and by means of conventional signs, gives information as to wells, caravan routes, and relative importance of towns and villages. A short note on the physical features of the country is given in the south-east corner of the map.

Tripoli. **Service Géographique de l'Armée, Paris.**

Plan de Ghadamés. Scale 1:10,000 or 6·3 inches to 1 stat. mile. Paris: Service Géographique de l'Armée, 1911.

AMERICA.

Bolivia. **Ampuero and Aramayo del Rio.**

Mapa Telegrafico de Bolivia. Formada por el Director General de Telégrafos Sr. Luis P. Ampuero y colaborado por el Ingeniero Sr. C. Aramayo del Rio con autorización del Ministerio del ramo. Scale 1:2,400,000 or 1 inch to 37·8 stat. miles. La Paz: Imprenta y Litografia Boliviana, 1911. *Presented by the Direccion General de Estadística y Estudios Geográficos, La Paz.*

A sketch-map showing, by various symbols, the different telegraph lines constructed and projected. State lines are distinguished from those belonging to private companies.

Bolivia. **Direccion General de Estadística y Estudios Geográficos, La Paz.**

Mapa demostrativo del desarrollo de los Ferrocarriles en Bolivia, 1911. Scale 1:5,000,000 or 1 inch to 78·9 stat. miles. La Paz: Direccion General de Estadística y Estudios Geograficos, 1911. *Presented by the Direccion General de Estadística y Estudios Geográficos, La Paz.*

An outline sketch-map showing railways constructed and under construction, as well as others which have been projected and those of which the surveys have been made. Tables of distances and other particulars are given below the map.

Brazil. **Ministerio da Viação e Obras Publicas do Brasil.**

Mappa dos Estados do Ceara, Rio Grande do Norte e Parahyba com parte dos estados limitrophes pelo Serviço Geologico e Mineralogico do Brasil. Orville A. Derby, Chefe, sob a direcção dos engenheiros Horace E. Williams e Roderic Crandall. Scale 1,000,000 or 1 inch to 15·8 stat. miles.—Mappa do Estado do Ceará. Mandado Confecionar por S. Exa. o Snr. Dr. Francisco Sa, Ministro da Viação e Obras Publicas. Scale 1:650,000 or 1 inch to 10·2 stat. miles. Rio de Janeiro: Ministerio da Viação e Obras Publicas, 1910.

Two maps based upon recent surveys and sketches made on behalf of the geological and mineralogical service of Brazil, under the direction of Messrs. Horace E. Williams and Roderic Crandall. On the first map the conventional signs employed are in accordance with the symbols to be adopted on the 1:1,000,000 International map of the world, upon which scale it has been drawn, evidently with the view of its forming part of the International map later on. Although only of a provisional nature, the maps are a great advance upon any others of the same states that have previously appeared.

Canada. **Department of Militia and Defence, Ottawa.**

Topographic map of Canada. Scale 1:63,360 or 1 inch to 1 stat. mile. Sheet 28, Lachute. Published by the Geographical Section, General Staff, War Office. London: Edward Stanford, Sifton Praed, and T. Fisher Unwin, 1910. *Price 2s. net each sheet. Presented by the Director of Military Operations.*

Chile. **Direccion de Obras Publicas, Santiago.**

Mapa Escolar de Chile mandado hacer por orden del Señor Ministro de Instruccion Publica Don Domingo Amunátegui Solar durante la Presidencia del Ex^mo^ Señor Don Pedro Montt. Construido segun los últimos datos jeograficos en la Inspeccion Jral. de Jeografía i Minas de la Direccion de Obras Públicas, Injeniero Jefe Jose del C. Fuenzalida. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. [Santiago: Direccion de Obras Publicas], 1911. *Presented by Justus Perthes Geographischer Anstalt, Gotha.*

A large diagrammatic school wall-map of Chile, printed in colours and showing relief on the layer system, with tints of green, yellow, and reddish-brown, superimposed upon hill-shading. This gives the general form of the mountain ranges and hills, and provides a base for the tinting. Depths of water are shown by different tints of blue. The map is mounted on linen, and measures 5¼ feet by 7 feet. It has been prepared by

order of the Chilian Minister of Public Instruction, and lithographed and printed by the firm of Justus Perthes, Gotha.

AUSTRALASIA.

Australia. **Stanford.**

Stanford's General Map of Australia. Scale 1 : 5,068,800 or 1 inch to 80 stat. miles. London : Edward Stanford, 1912. *Price 3s.*

A useful general map of Australia with up-to-date information, showing the newly authorized transcontinental railway from Adelaide to Perth, as well as the site of the capital.

GENERAL.

German Colonies. **Sprigade and Moisel.**

Grosser Deutscher Kolonialatlas. Bearbeiten von Paul Sprigade und Max Moisel. Herausgegeben vom Reichs-Kolonialamt. Ergënzungs-Leiferung 3, Kamerun : No. 3, Bauchi ; 5, Fumban ; 8, Lomie. Berlin : Dietrich Reimer (Ernst Vohsen), 1911. *Price 3m. each part. Presented by the Publisher.*

A comparison of these sheets with the earlier editions published ten years ago will show that a remarkable amount of fresh information has been obtained during the interval, notwithstanding the fact that in certain parts blank spaces still appear. This is greatly due to the activity of German military and other officials, who have made good use of opportunities afforded them of adding to the geographical knowledge of the parts they have visited by making route sketches and maps of their travels. Sheet 5 is in great measure filled in by the surveys of the Yola-Cross River Boundary Commission, the line of which boundary is also shown, although a note is added to the sheet stating that it has not yet been ratified.

Map Projection. **Clark.**

Clark's Measurement Map. A New World Map on the Sinusoidal Curve Projection. By Alex. Clark, ASS.M.INST.C.E., F.R.S.S.A. EDIN. 2nd edit., 1911. Pawson & Brailsford, printers, Sheffield. (Copyright.)

This is the well-known sinusoidal projection which generally bears the joint names of Sanson-Flamsteed, owing to its having been used by Nicholas Sanson for maps in his general atlas in 1650, and by John Falmsteed, the Astronomer Royal, for his 'Atlas Cœlestis,' in 1729. The projection was, however, known at a still earlier date, and was probably first used for the maps of Africa and America in the 1606 edition of Mercator's atlas. Maps of continents, specially Africa, have been frequently drawn upon it in recent years, but for the whole world it cannot be recommended, notwithstanding the fact that equal areas are preserved, owing to the great distortion in the configuration of the land when it is made to embrace many degrees of longitude from the central meridian. The projection is shown as drawn for the world, and its construction explained, in Germain's 'Traité des Projection des Cartes Géographique,' Wenz, 'Atlas zur Landkarten-Entwurfs-Lehre,' 'The Theory of Map Projections,' by J. I. Craig, M.A., of the Egyptian Survey Department and other works dealing with the subject.

Mr. Clark has provided scales which it is suggested will facilitate the measurement of distances and setting off bearings; but these could only give approximate results.

World. **Bachmann.**

Verbreitung und Intensität des Reisbaus auf der Erde. Entworfen von Dr. C. Bachmann. Equatorial scale 1 : 100,000 or 1 inch to 1578·2 stat. miles. *Petermanns Mitteilungn*, Jahrgang 1911, I., Tafel 3. Gotha : Justus Perthes, 1912. *Presented by the Publisher.*

World. **Banse.**

Die geographische Gliederung der Erdoberflache. Von Erwald Banse. Scale 1 : 100,000,000 or 1 inch to 1578·2 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1912, I., Tafel 1. Gotha : Justus Perthes, 1912. *Presented by the Publisher.*

World. **Geographical Section, General Staff, War Office.**

International map of the World. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheets : North K 35, Istambul (Constantinople) : South H 34, Kenhardt (Cape of Good Hope). Drawn and printed at the Geographical Section, General Staff, War Office. London : Edward Stanford, Sifton, Praed, T. Fisher Unwin, 1911–12. *Price 2s. net each sheet. Presented by the Director of Military Operations.*

Sheet North K 35 includes the south-eastern part of the Balkan peninsula and adjacent shores of Asia Minor lying between lat. 40°–44° N. and long. 24°–34° E.,

whilst on sheet South H 34 are shown the parts of the Cape of Good Hope, British Bechuanaland, and German South-West Africa between lat. 28°-32° S. and long 18°-24° E. Both sheets have been carefully produced and printed in colours to show relief according to the system agreed upon at the meeting of the International Map Committee held in London. Complete explanation is given of the conventional signs employed, and in the case of the former sheet, information is also given on the pronunciation of names in Bulgaria, Rumania, and Turkey.

World. **Herbertson.**

Oxford Outline Maps. Edited by Prof. A. J. Herbertson. World: Western and Eastern Hemispheres; World: Polar Hemispheres; World: Mollweide's Elliptical Equal Area Net; Western Europe: Outlines for Weather Map; Great Britain: Outlines for Climate Map; Contour Map Exercise, devised by Dr. H. R. Mill; Combined Weather Chart, designed by J. F. Unstead. Oxford: The Clarendon Press, 1912. *Price 1d. net each. Presented by the Publishers.*

A set of outline maps and diagrams intended for the use of geographical students. The equal-area maps will be useful for showing by colours or symbols the distribution of natural phenomena, while the climate and weather maps and diagrams can be filled in for any month or other period, and become most instructive. The Contour Map Exercise, devised by Dr. H. R. Mill, consists of a sheet of paper covered with figures and spots indicating their position. Figures in heavy type denote depth below sea-level in fathoms, while others in lighter type, show heights above sea-level in feet From these figures the student is required to draw the contour lines at stated intervals, and so reproduce a map.

World. **Langhans.**

Der Salzgehalt an der Oberfläche der Meer im Verhältnis zur Süsswasserzufuhr der Stromgebiete und zur Höhe der Randgebirge. Scale 1: 80,000,000 or 1 inch to 1262·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1912, I., Tafel 2. Gotha: Justus Perthes, 1912. *Presented by the Publisher.*

World. **St. Martin and Schrader.**

Atlas Universel de Géographie construit d'après les sources originales et les documents les plus récents cartes, voyages, mémoires, travaux géodesiques, etc. Avec une texte analytique. Ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Carte No. 53, Chine. Paris: Hachette & Cie. *Presented by the Publishers.*

Practically the whole of China Proper is included on this sheet, which forms No. 8 of a general ten-sheet map of Asia on the scale of 1:5,000,000. Like all the other sheets in the atlas, this is an excellent specimen of engraving, the hills being very effectively shown by vertical hachures; but the fact that they are printed in black gives it a somewhat heavy appearance. There is a separate list of the documents consulted.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, from January 1 to 27, 1912. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 3768, North sea, Denmark and Germany: Esbjerg approaches, including Knude Dyb and Horns Rev., 3*s*. 3451, North Atlantic ocean, Bermuda islands: Murray's anchorage, 2*s*. 397, South America, north-east coast: Plans on the north coast of Brazil: Port of Pará, 3*s*. 2833, China, north coast: Fort head to Kinchau, including Kwang tung (Society) bay, 3*s*.—**New Editions.**—No. Y, The World: Index chart of Admiralty sailing directions, 1*s*. X, 11, Explanation of signs and abbreviations on Admiralty charts, 2*s*. 1967, England, south coast: Plymouth sound, 3*s*. 1721, England, east coast: Coquet road and channel, 3*s*. 3203, Spitsbergen islands: Magdalena bay to Red bay. Plans added: Danes Gat. Fair haven and approaches, 3*s*. 2687, Gulf of St. Lawrence, Cape Breton island; Little Bras d'Or lake, and St. Ann and Sydney harbours (Plans: Baddeck harbour, Bras d'Or), 3*s*. 2818, United States, east coast: Hampton roads and Elizabeth river, 3*s*. 657, Central America: Isthmus of Panama, showing the proposed Panama canal and the railway, 2*s*. 8*a*, Red sea, sheet 1 (Plans: Tor harbour. Sherm Yahar, Sherm Jubba), 3*s*. 2837*a*, Persian gulf, eastern sheet: (Plans: Kishm and parts adjacent, Kais anchorage, Henjam island and anchorage, Chárak, Abú Thabi, Khor Fakán bay, Chiru), 3*s*. 125, Persian gulf: Mouth of the Euphrates—Shatt al Arab and Bahmishir river, the bar below Muhammera, Karun river. Plan added: Al basra anchorage, 3*s*. 38, Arabian sea: Maskat to

Karáchi (Plans: Chahbár bay, Gwatar bay, Gwádar bay), 3s. 949, Ports in the Philippine islands: Port Galera and Varadero bay, Sabelayan anchorage, Port Kancan (New plan of Port Conception on this sheet), 2s. 2119, Australia, east coast: Newcastle harbour, 3s.

(*J. D. Potter, Agent.*)

America—Great Lakes. **U.S. Weather Bureau.**

Meteorological chart of the Great Lakes, February, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, January, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, February, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, February, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Atlantic, South. **U.S. Hydrographic Office.**

Pilot chart of the South Atlantic Ocean, March, April, and May, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Burma. **Hunton and Smith.**

Burma. Rangoon River. North D'Silva Point to Kyauktan or Hmawun Creek. Surveyed, July to September, 1911, by A. S. Hunton, River Surveyor, and V. G. Smith, Asst. River Surveyor, under the direction of H. G. G. Ashton, Deputy Conservator of the Port. Scale 1 : 18,133 or 3·4 inches to 1 stat. mile. Rangoon: Commissioners for the Port, 1911. *Presented by H. G. G. Ashton, Esq., Deputy Conservator of the Port of Rangoon.*

Indian Ocean. **Meteorological Office**

Monthly Meteorological charts of the Indian Ocean, February, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, March, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **U.S. Weather Bureau.**

Meteorological chart of the Indian Ocean, February, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Pacific. **U.S. Hydrographic Office.**

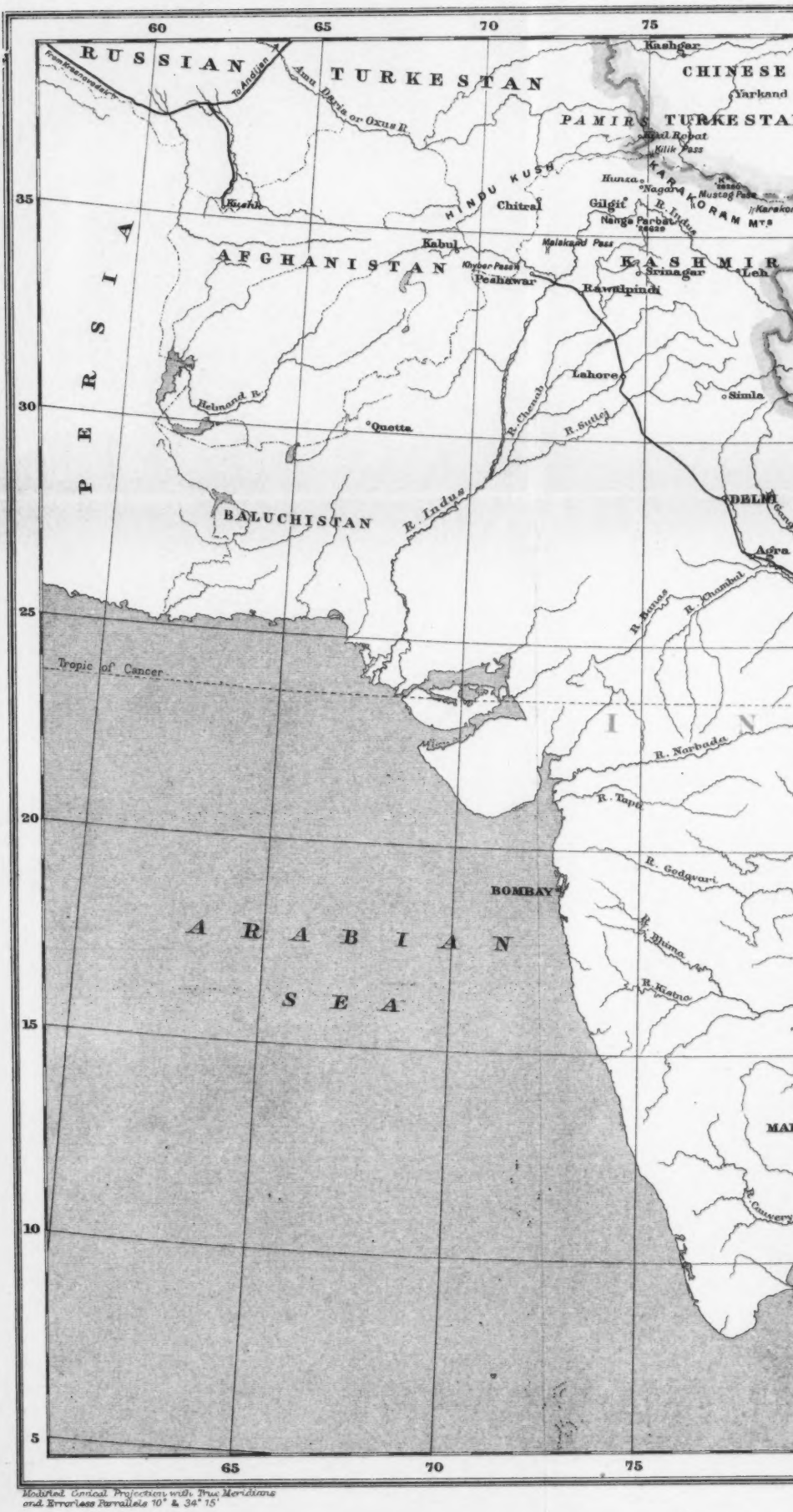
Pilot chart of the North Pacific Ocean, March, 1912. Ditto, South Pacific Ocean, March, April, and May, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

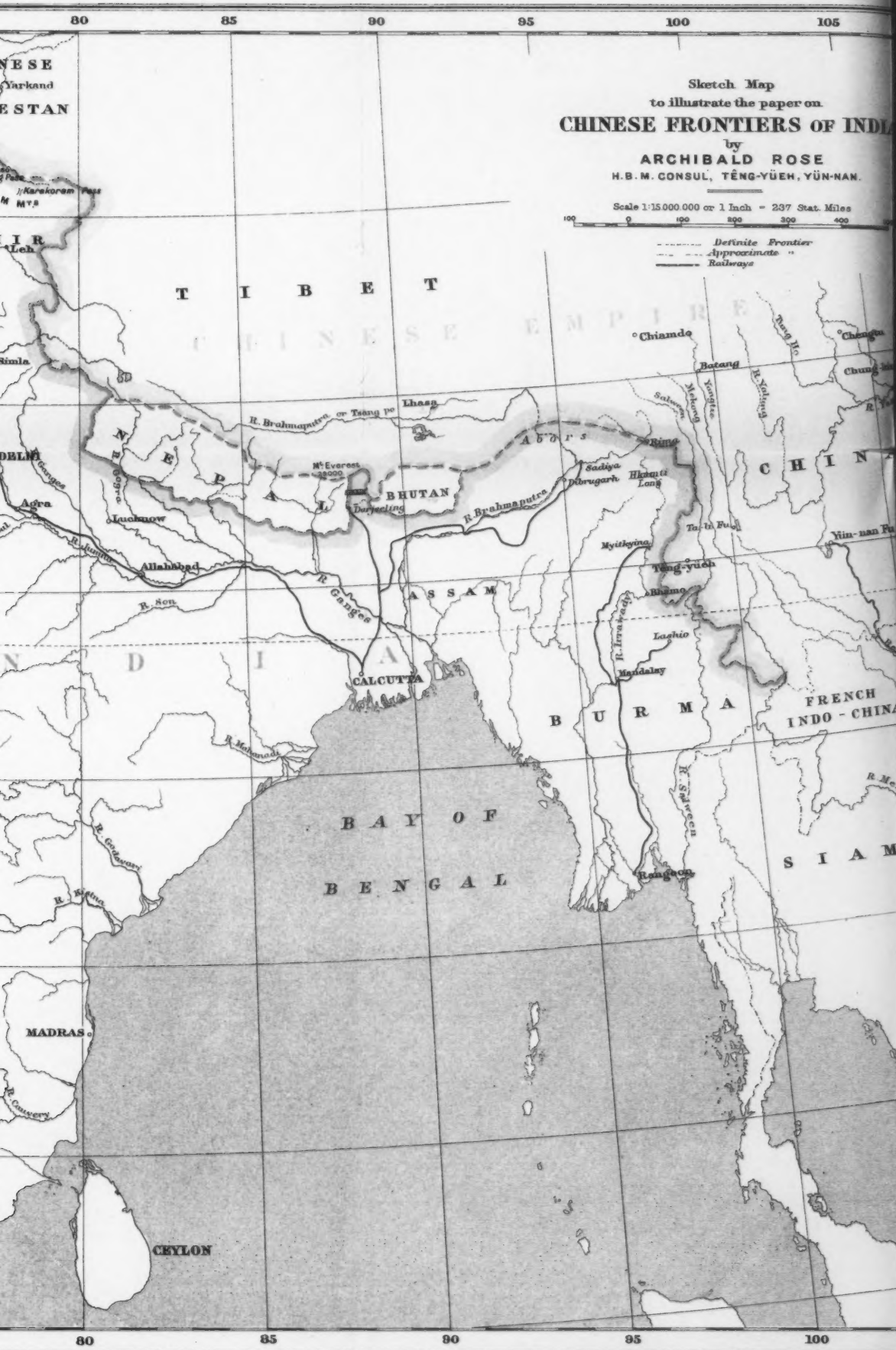
Meteorological chart of the North Pacific Ocean, February, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

PHOTOGRAPHS.

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



Modified Conical Projection with True Meridians and Errorless Parallels 10° & 34° 15'



Published by the Royal Geographical Society.

Modified Oracal Projection with True Meridians and Errorless Parallels 16° 20' & 27° 40'

98
100
102
30
28
26
24
22
20
18
16
Batang
Litang
Ta-chien-lu
Ya-chou Fu
Garthok
Tung Ho
S E - C H U A N
Yangtze R.
Yalung R.
Atuntze
Rima
Chamutong
Mekong R.
Salween R.
Chung-tien
Yung-ning
Ning-yüan Fu
Yalung R.
Yang-tze R.
Hkamti Long
Wei-hsi-ting
A-hsi
Li-chiang Fu
Mali Hka
Nmai Hka
Pien-ma
Pien-shui-kiang
Teng-kang
Ta-chu-pa
Ta-li Fu
Chao Chou
Myitkyina
L a s h i
L a l o
Yung-chang Fu
YUN-NAN FU
Teng-yüeh Ting
Y Ü N - N A N
Lung-ling Ting
Shun-ning Fu
Taping R.
Bhamo
Katha
Shweli R.
Nam-khan
Nam-tung R.
Mekong R.
Lin-an Fu
Red R.
Kun-long
Pu-erh Fu
Lashio
Sau-mao Ting
Chên-pien Ting
NDALAY
Keng-hung
M A
Keng-tung
Taungyi
FRENCH
INDO-CHINA
Luang Prabang
Salween R.
Chieng-mai
Mekong R.
Pre
Wieng Chan
Nakong Kai
Me-nam
S I A M
NGOON
Moulmein
Sketch Map
of the
BURMA-CHINA FRONTIER
Scale 1:7,000,000 or 1 Inch = 110·48 Stat. Miles
50 0 50 100 150 200

INDIA
Rose

Note.

This Map is from a plane table survey by Professor J. Norman Collie, based upon the map of the "Yellowhead Pass Route," by Mr. J. McEvoy, B.A.Sc., of the Canadian Government Survey, which accompanies Part D., Vol XI., of the Report of the Geological Survey of Canada, 1900. The positions of Roche Miette, Roche Jacques, Roche Suette, and the Athabasca and Stoney rivers were laid down exactly as they are on that map, and the plane table survey of the mountainous region to the north of the Yellowhead Pass and Moose Lake adjusted to them. A traverse with the plane table was first run up the Stoney river as far as its source and Mt. Hoodoo, and rays were drawn to peaks on either side of the valley which were intersected from other points later on. Numerous photographs were taken during the expedition, many of which were used in the construction of the plane table map, and provided means of testing its general accuracy.

The position of Mt. Robson as determined by Professor Norman Collie differs only about one mile from that given by Professor A. P. Coleman (see map in Geographical Journal, July 1910).

The heights underlined are taken from Mr. J. McEvoy's map, while those in brackets are rough estimations; all others are from Professor Norman Collie's readings of an aneroid, which was checked frequently by comparison with a mercurial barometer. They were computed by Professor Norman Collie with a mean sea-level of 30 ins., and should be considered as approximate only. In all cases the heights are above sea level.

Published by the Royal Geograp

118°30'
To Bamaus R. 28 miles
To Muskeg R. 30 miles
To Sulphur R.
Rock Lake
Deer Creek
Falls
Two Rock Peaks
Snow Mt
Great Creek
Yellowhead Pass
3723
Yellowhead Mt
Yellowhead Lake
3614
MIETTE Mts
Mt Geikie
11,000
Grand Trunk Railway open
" " " constructing
118°30'

DOMINION OF CANADA

Part of the

ROCKY MOUNTAINS

North of the Yellowhead Pass

from a plane table survey by

PROFESSOR J. NORMAN COLLIE, F.R.S.

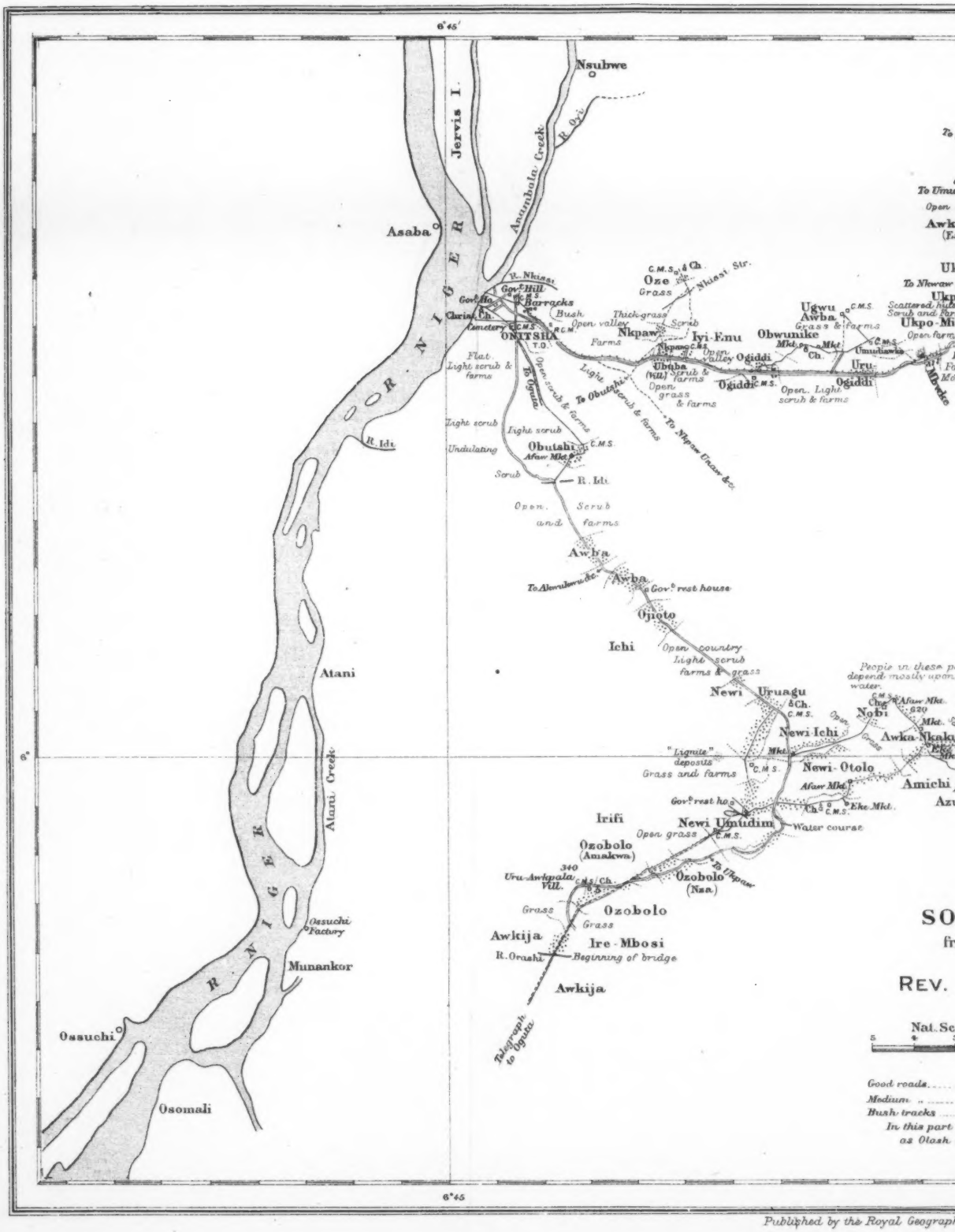
1910-11.

Nat. Scale 1: 500,000 or 1 Inch = 7·89 Stat. Miles

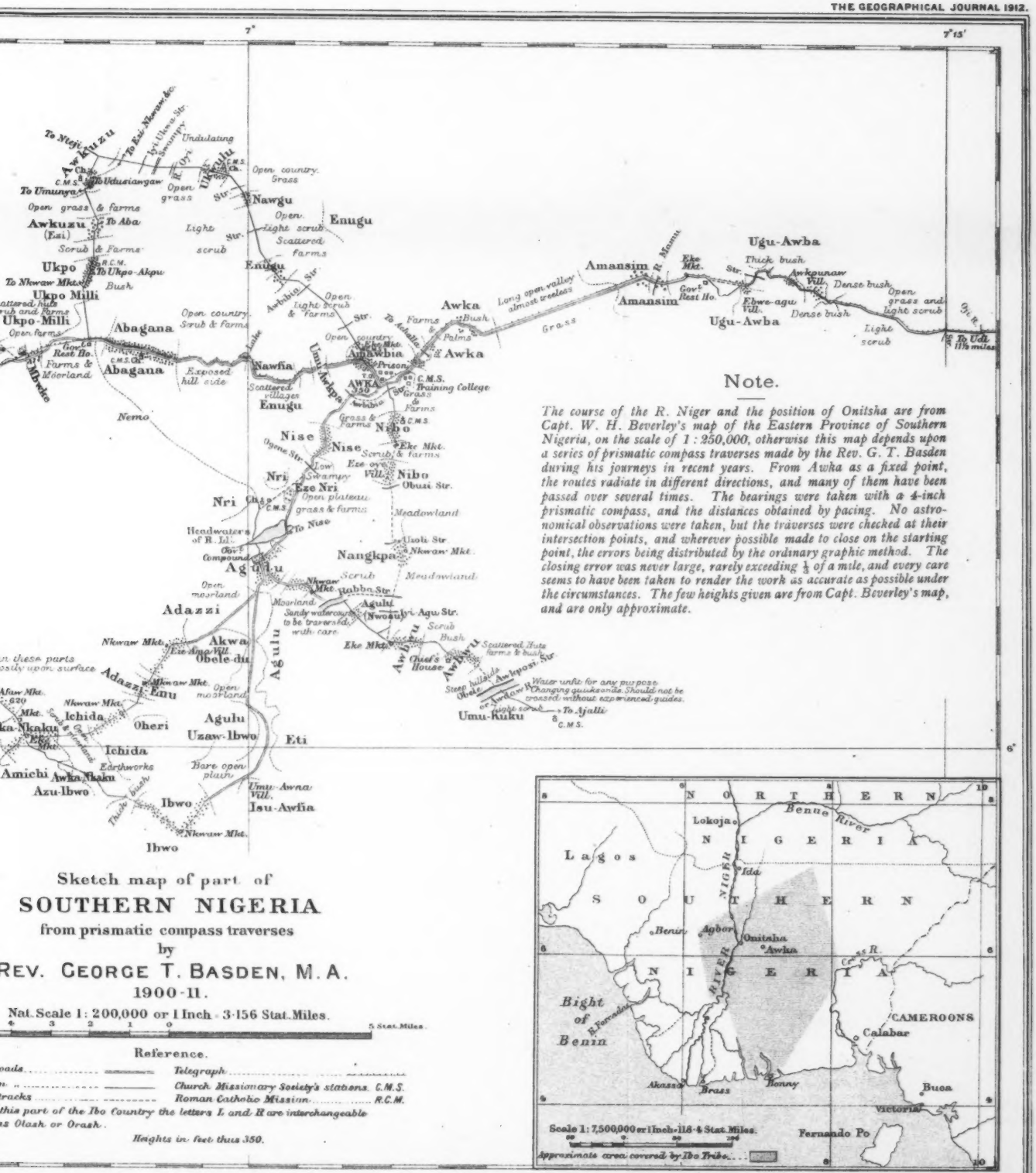
10 5 0 10 Miles

Route

Heights in feet.



Published by the Royal Geograp



Note.

The course of the R. Niger and the position of Onitsha are from Capt. W. H. Beverley's map of the Eastern Province of Southern Nigeria, on the scale of 1 : 250,000, otherwise this map depends upon a series of prismatic compass traverses made by the Rev. G. T. Basden during his journeys in recent years. From Awka as a fixed point, the routes radiate in different directions, and many of them have been passed over several times. The bearings were taken with a 4-inch prismatic compass, and the distances obtained by pacing. No astronomical observations were taken, but the traverses were checked at their intersection points, and wherever possible made to close on the starting point, the errors being distributed by the ordinary graphic method. The closing error was never large, rarely exceeding $\frac{1}{2}$ of a mile, and every care seems to have been taken to render the work as accurate as possible under the circumstances. The few heights given are from Capt. Beverley's map, and are only approximate.

Sketch map of part of

SOUTHERN NIGERIA

from prismatic compass traverses

by

REV. GEORGE T. BASDEN, M.A.

1900-11.

Nat. Scale 1: 200,000 or 1 Inch = 3·156 Stat. Miles.

4 3 2 1 0 5 Stat. Miles.

Reference.

Roads ..... Telegraph .....

Paths ..... Church Missionary Society's stations C.M.S.

Cart tracks ..... Roman Catholic Mission ..... R.C.M.

In this part of the Ibo Country the letters I and R are interchangeable as Olash or Orash.

Heights in feet thus 350.

Geographical Society.